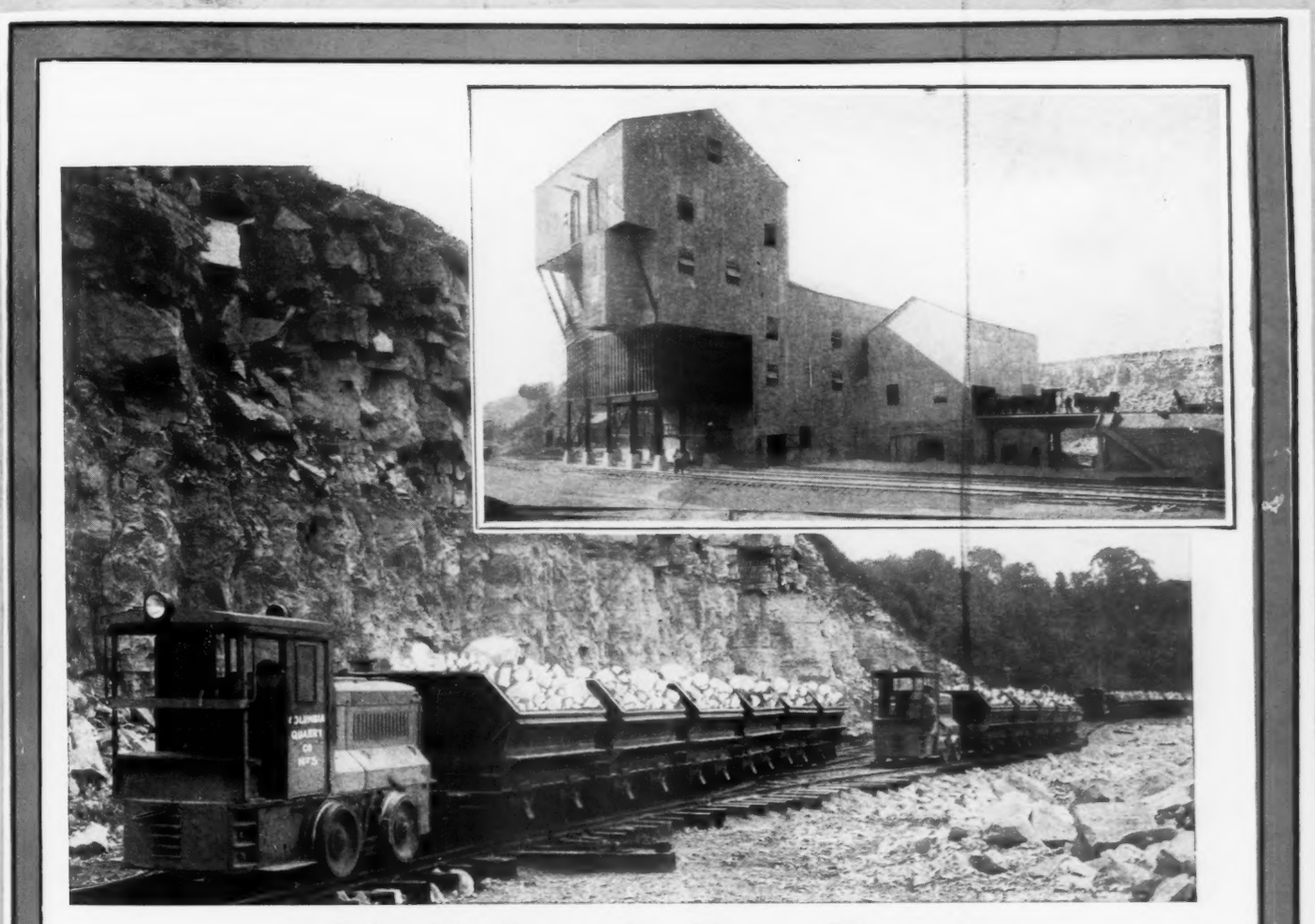
East Engin.
Library

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Chicago, December 26, 1925 (*Issued Every Other Week*) Volume XXVIII, No. 26



Columbia Quarry Co. Chooses Plymouths

The Columbia Quarry Co., of St. Louis, has just erected a new plant at Krause, Ill., that is the "last word" in design and construction. The plant is of all steel-concrete construction and contains a number of new features that mark a distinct advance in the art of crushing, screening and handling stone.

Five Plymouth Gasoline Locomotives were chosen to start the haulage work with more to follow.

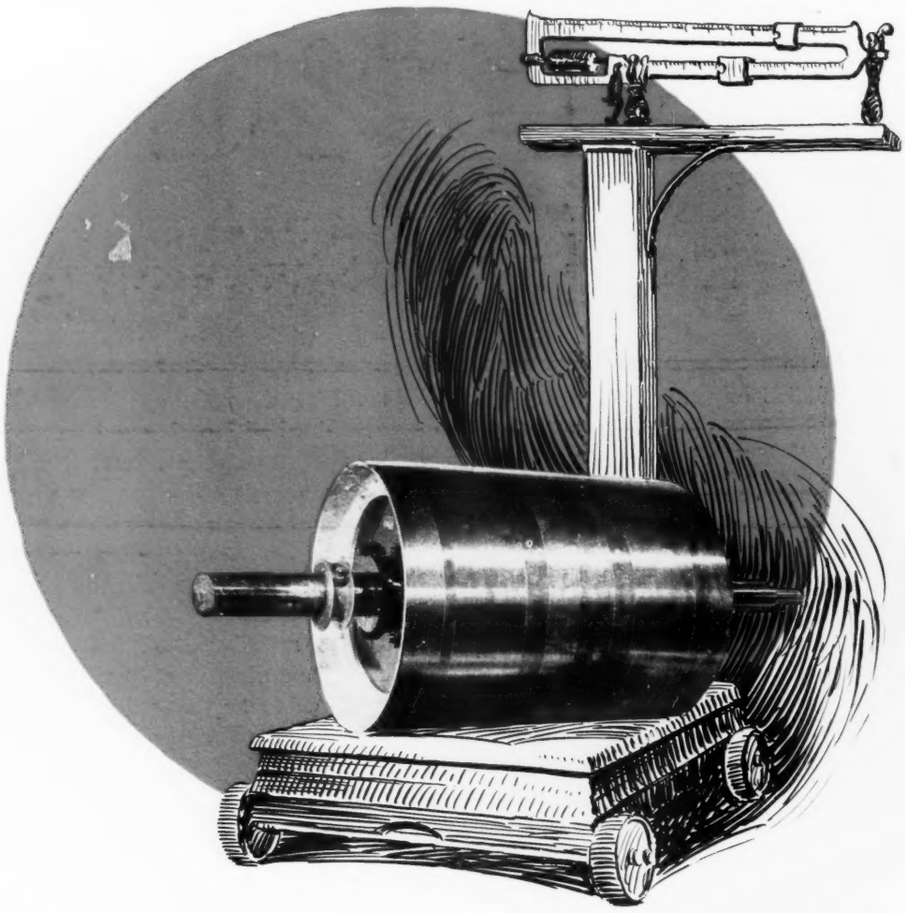
Write us for handsomely illustrated rotogravure bulletin showing this remarkable plant and equipment in detail.

The Fate-Root-Heath Co., Plymouth, Ohio

PLYMOUTH
Gasoline Locomotives

MEMBER A.B.C. *The Only Paid Circulation in this Industry* MEMBER A.B.P.

REVIEW AND DIRECTORY NUMBER — 50 CENTS



Weigh that magnetic pulley—
that tells of the strength!

THE heavier your magnetic pulley is, the stronger it is—the surer it is of pulling out that iron from its bed in material.

The weight tells of the iron and wire, the materials that are responsible for a real magnetic pull, real magnetic flux. You can't have a strong pulley with air and waste spaces. That is why the Dings is heavier—in order to give you your money's worth.

Weigh it!

Dings Magnetic Separator Co.
803 Smith St., Milwaukee, Wis.

Birmingham
513 N. 21st St.

Buffalo
988 Ellicott Square

Chicago
115 S. Dearborn St.

Cincinnati
Mercantile Library Bldg.

Cleveland
Leader-News Bldg.

Denver
1718 California St.

Detroit
805 Hammond Bldg.

Los Angeles
San Fernando Bldg.

New York
52 Vanderbilt Ave.

Pittsburgh
1522 Oliver Bldg.

Salt Lake City
201 Dooly Block

San Francisco
419 Call Bldg.

St. Louis
410 Granite Bldg.

Kansas City
725 Livestock Exch. Bldg.

Dings High Intensity MAGNETIC SEPARATION

RP12-26S-RTG

Rock Products
CEMENT and ENGINEERING NEWS
WE extend to all our Friends and readers our best Wishes for a satisfactory and prosperous New Year.
We thank them for the many Evidences of Friendship and Helpfulness in preparing this and every Issue of Rock Products.
We pledge them our continued efforts to help in every way the Promotion, Prestige and Prosperity of these Industries.
—The Editors
December 26, 1925

A few samples of the plants added to the rock products industry in 1925 and described in current issues of Rock Products

Little Doubt 1926 Will Be As Good to Rock Products Industry as 1925

And in 1925 the Rock Products Industry Has Had a Full Share in the General Prosperity of the United States

IT would be useless to enlarge on the present prosperity of the United States, for there is ample evidence of it, and there is little doubt that most rock products producers and manufacturers have shared in it. There were, unfortunately, a few sections of the country where local conditions held back construction work; but even here the retarding influences were less pronounced than they have been in times past.

Self-Evident Prosperity

In general, practically all the major rock products industries—cement, lime, gypsum, crushed stone, sand, gravel, and slag showed increases in production over 1924 of approximately 7 to 8%, by every test we have been able to apply. As was the case a year ago, gypsum products showed the largest percentage of increase over 1924 production—approximately 20% in value. (Production in terms of tonnage is not a fair test of the progress made by gypsum because much of it is now being manufactured into products, the value of which increases in a much greater ratio than the tonnage of raw gypsum and gypsite mined.)

1925 Was 8% Better Than 1924

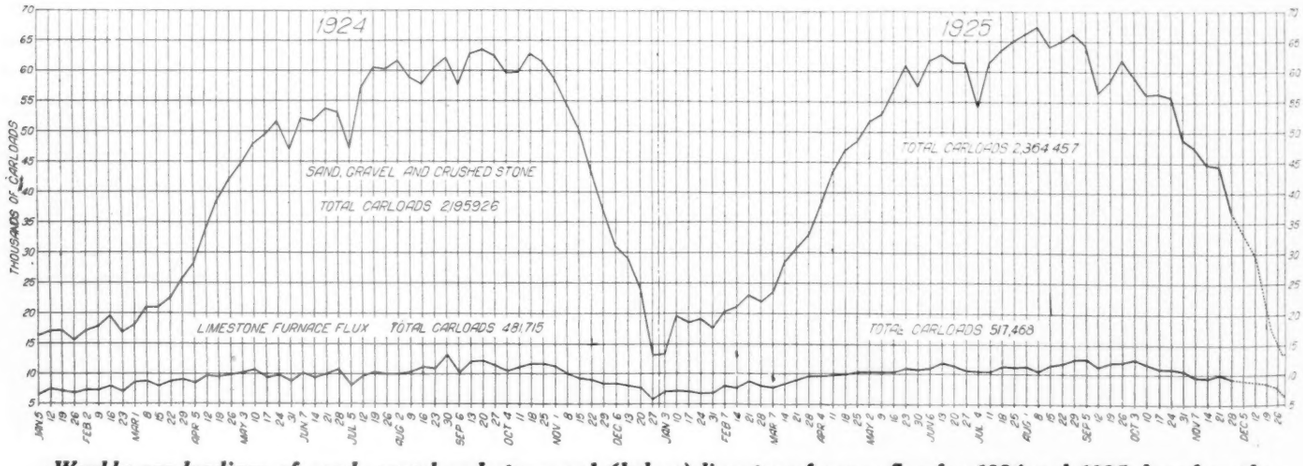
There certainly is little reason to believe at this writing that 1926 will be less active in any line of business than 1924. Better prophets than we see every indication of uninterrupted and undiminishing demand for construction materials; and the changed aspect of agriculture in the last few months has already been felt by agricultural limestone and rock phosphate producers, whose business with the farmers picked up remarkably in the closing months of the year. The outlook for the iron and steel industry is good, and there is more reason than ever to believe that long delayed programs for railway maintenance-of-way improvements will materialize in 1926. There is every indication of a very active year in public works construction, and much of the surplus earnings of many industries will find an outlet in new buildings and improved manufacturing facilities.

No Let-Up in 1926

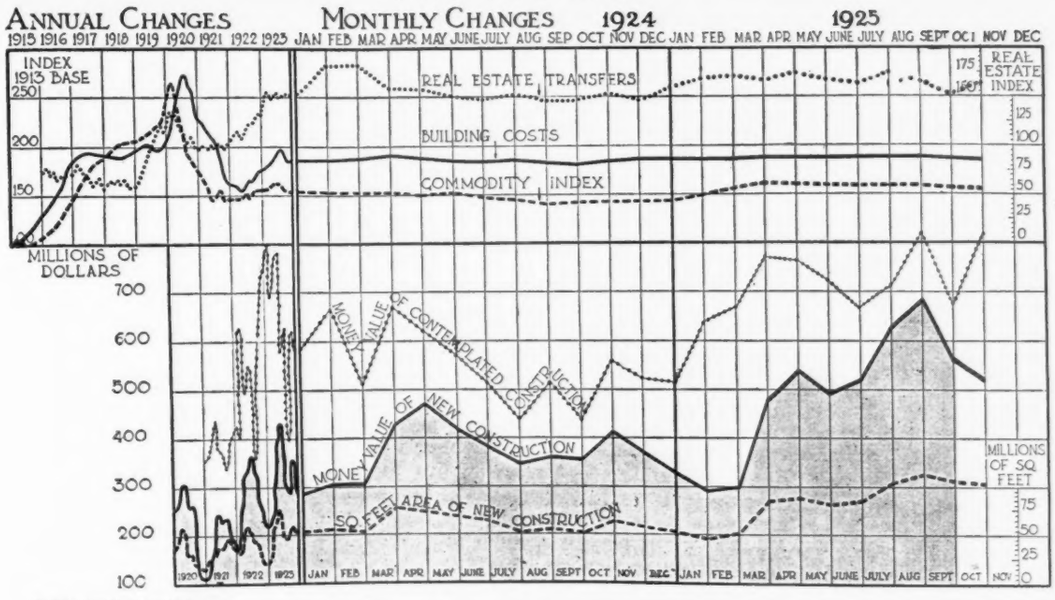
Some prophets find the tremendous extension of the credit system—the time-payment plan on radios, automobiles, houses and what not—a menace to our continued prosperity. There is, however, an angle to this credit system that receives little comment; that is the constantly increasing desire and effort on the part of all business interests to maintain prosperity. This tendency is further enhanced by the greater and growing ownership of big business by the average man through small investments. If everyone wants continued prosperity and works for continued prosperity, we shall most certainly have continued prosperity, because it means keeping money in circulation by the purchase of things we need and things we want, whether it be radios or highway pavements. There is no reason to believe we have absorbed our fill of either; nor is there really such a thing as a normal year, since our normal desires of yesterday were measured by our means of yesterday and are outgrown, individually and collectively, by our means and desires of today.

Generally Healthful Conditions

There is ample evidence on every side of increasing



Weekly car loadings of sand, gravel and stone and (below) limestone furnace flux for 1924 and 1925, based on the statistics of the Car Service Bureau of the American Railway Association


ANNUAL CHANGES
MONTHLY CHANGES 1924 1925
1915 1916 1917 1918 1919 1920 1921 1922 1923 JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC
INDEX 1913 BASE
REAL ESTATE TRANSFERS
BUILDING COSTS
COMMODITY INDEX
REAL ESTATE INDEX
MILLIONS OF DOLLARS
MONEY VALUE OF CONTEMPLATED CONSTRUCTION
MONEY VALUE OF NEW CONSTRUCTION
SQ. FEET AREA OF NEW CONSTRUCTION
MILLIONS OF SQ. FEET

© The Architectural Forum

The Building Situation at a Glance

The chart shown here has been developed for the purpose of showing at a glance the situation in the building field at present and during the past few years by indicating the following components:

1. Index line showing relative number of realty transfers.
2. The index line showing the variation in building costs since 1915.
3. The index line showing the variation in general commodity costs since 1915.
4. A graphic record of the monthly totaled values of plans filed in the United States since 1919.
5. A graphic record of the monthly totals of contracts let in new construction in the United States since 1919.
6. A graphic record of the monthly totals of the volume of new building in the United States since 1919 as measured in square feet.

This information is developed from the following sources of data:

The FORUM record of building costs; reports of the United States Department of Commerce; reports of the F. W. Dodge Corporation; reports of *Engineering News-Record*, and from the Natl. Assn. of Real Estate Boards.

BUILDING TYPES	N EASTERN STATES	N. ATLANTIC STATES	S. EASTERN STATES	S. WESTERN STATES	MIDDLE STATES	WESTERN STATES	U. S. A.
Automotive	24,262,500	43,042,500	9,970,000	9,877,500	49,877,500	15,072,500	152,102,500
Banks	18,295,000	55,550,000	10,022,500	22,135,000	59,317,500	20,930,000	186,250,000
Apartments	25,272,500	329,042,500	40,620,000	18,627,500	137,565,000	50,540,000	601,667,500
Apartment Hotels	8,487,500	52,850,000	12,712,500	9,425,000	71,927,500	36,612,500	192,015,000
Clubs Fraternal, etc.	15,837,500	79,845,000	18,437,500	15,727,500	92,137,500	33,697,500	255,682,500
Community Memorial	18,030,000	53,812,500	4,712,500	9,772,500	38,287,500	24,835,000	149,450,000
Churches	39,370,000	79,232,500	17,537,500	41,510,000	78,042,500	28,752,500	284,445,000
Dwellings (Under $20 000)	11,635,000	104,227,500	20,312,500	13,675,000	49,012,500	30,277,500	229.140,000
Dwellings ($20 000 to $50,000)	9,985,000	49,217,500	10,415,000	12,040,000	35,225,000	9,142,500	126,025,000
Dwellings (Over $50,000)	7,295,000	27,372,500	5,287,500	5,807,500	27,985,000	9,737,500	83,485,000
Hotels	45,275,000	131,125,000	59,747,500	40,522,500	240,480,000	68,035,000	585,185,000
Hospitals	35,700,000	112,662,500	8,925,000	16,045,000	87,410,000	49,150,000	309,892,500
Industrial	42,632,500	248,917,500	6,527,500	29,810,000	130,962,500	24,542,500	483,392,500
Office Buildings	38,727,500	240,527,500	38,932,500	37,017,500	212,005,000	96,337,500	663,547,500
Public Buildings	18,597,500	79,242,500	19,760,000	19,325,000	49,057,500	39,382,500	225,365,000
Schools	68,815,000	255,202,500	23,017,500	38,400,000	236,992,500	68,217,500	690,645,000
Stores	8,660,000	38,027,500	11,150,000	7,032,500	43,415,000	14,932,500	123,217,500
Theaters	7,600,000	26,462,500	6,517,500	10,490,000	99,632,500	23,755,000	174,457,500
Welfare, Y M. C. A., etc.	5,775,000	35,077,500	7,435,000	1,907,500	12,295,000	6,327,500	68,817,500
Total Value of New Buildings	450,252,500 8.1	2,041,437,500 -36.6	332,040,000 5.9	359,147,500 6.4	1,751,627,500 31.4	650,277,500 11.6	5,584,782,500

© The Architectural Forum

1926 FORECAST OF NEW BUILDING CONSTRUCTION
BY SIX GEOGRAPHICAL DIVISIONS (U. S.) AND NINETEEN BUILDING TYPES
PREPARED BY THE ARCHITECTURAL FORUM, 383 MADISON AVENUE, NEW YORK

competition and narrower margins of profit. For while production in the rock products industries in 1925 was quite generally 7 or 8% above 1924, prices were also quite generally 2 to 5% less. Profits were made by increased production and lower costs, not only in these industries but by industry in general. These are healthful signs, on the whole, and show that more and more a premium is being placed on good management and on business initiative. There has been but little indication of a return to old-time cut-throat competition even under provocative conditions. It is to be hoped that all producers have become broad-minded enough to understand the results of destructive competitive efforts not only to their own business and industry but upon society as a whole, and that future crises will be met with more intelligence.

Decreasing Prices General

Since the government is dependent, both directly and indirectly, upon the profits of business for its revenue, it will doubtless some day be recognized as a matter of government concern to curb wasteful investment and and effort through increase of producing facilities in excess of any reasonable or possible demand. We believe that if trade associations behave themselves, and business continues to be controlled by men of broad vision and "enlightened selfishness," it will one day become a legitimate function of these trade associations to exercise some kind of control to prevent disastrous over-expansion in their particular industries.

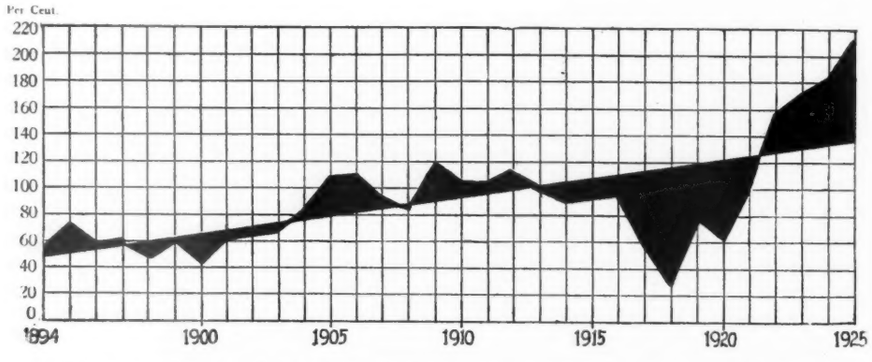
Must Find Way to Curb Overproduction

A possible productive capacity of 25% in excess of present demand is not a serious menace to prosperity. The steel industry has learned how to prosper with a much smaller proportionate capacity in operation. Indeed an excess of 25% producing capacity is a safe-guard both to the industry and the general public—the consumers. But there is evidence that some industries, like the cement industry, are expanding production facilities so rapidly that an excess producing capacity of more than 25% will soon result. Such an excess will be a real menace even in a most intelligently managed industry, because it is an economic waste.

Present Surplus Capacity Not Serious

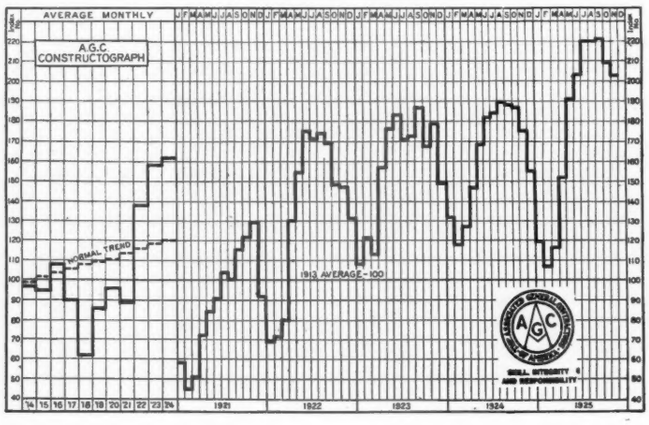
Decreasing prices and increasing production are in themselves proof that productive facilities are overtaking demand. There is a vast difference between reducing the cost and the price of a basic commodity like cement, and reducing the cost and price of a highly manufactured product like automobiles. The automobile may be made cheaper and lighter even though equally serviceable—there is less material and less labor in it, notwithstanding it bears the same trade-

Increased Economies Mean Increased Production



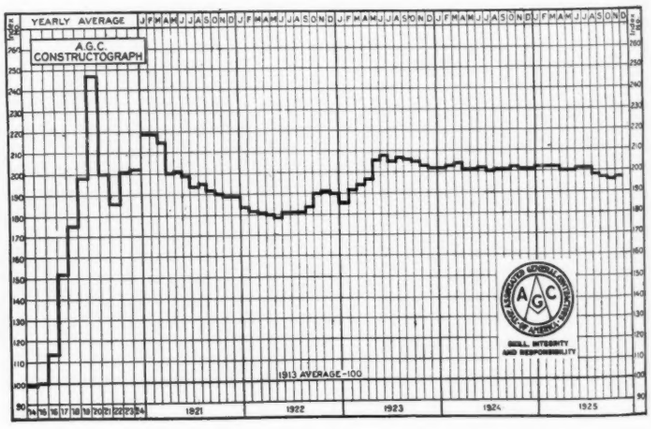
Building permits in the leading cities in percentages of 1913. (Changes in construction costs allowed for. Black areas represent deviations from the general trend)

VOLUME OF CONSTRUCTION



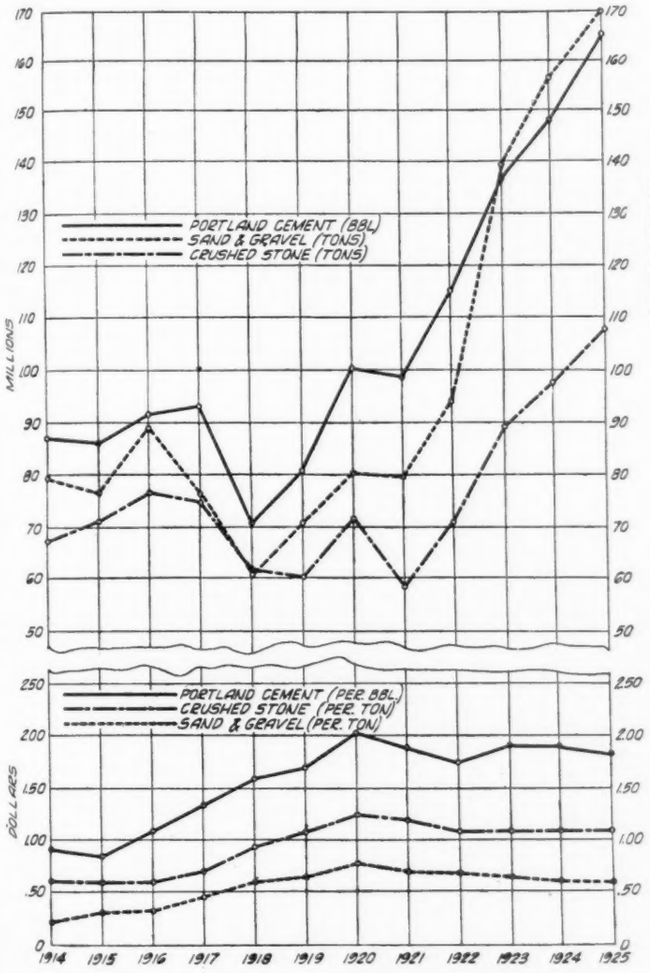
Showing large volume of construction in 1925

COST OF CONSTRUCTION



Showing relative steadiness of construction costs

mark. Cement cannot be made cheaper except by greater efficiency in production; the cost of the raw materials, the cost of labor, and the cost of capital remaining constant. With modern well designed plants about the only way to measureably increase the efficiency of production is to increase the output—to use the manufacturing facilities to the utmost. That is being done, and the effect is increased production and further complication of the problem brought about by over-production. The same is true of practically all the rock products industries. It is time to study costs and efficiency from every angle of the industry.

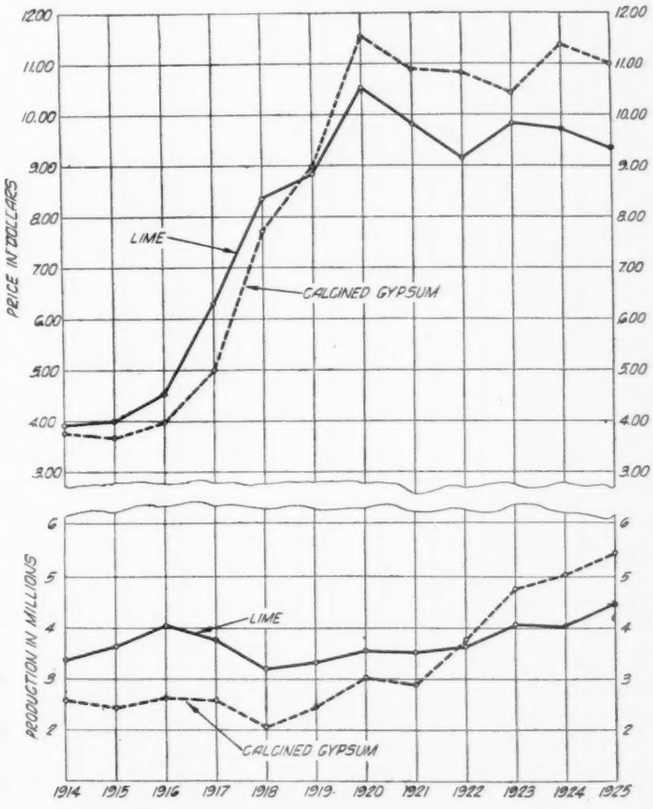

PORTLAND CEMENT (BBL.)
SAND & GRAVEL (TONS)
CRUSHED STONE (TONS)
MILLIONS
PORTLAND CEMENT (PER BBL.)
CRUSHED STONE (PER TON)
SAND & GRAVEL (PER TON)
DOLLARS
1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925

Above—Relative increases in production of cement, gravel and stone, 1914-1925. Below—Relative yearly average prices of cement, gravel and stone, 1914-1925

It is here that the business man who applies scientific and technical knowledge to his problems, as well as judgment and initiative, has the advantage; and we believe he will continue to have more and more advantage over his old-style competitor. Moreover, he is making business safer and more stable for all concerned. The concentration of business in large units is often brought about because such organizations can then be supervised by men of broad vision and greater appreciation of those problems which tie the success of business operations to the cultivation of public good will, skill in the selection and adoption of improved processes and equipment, and last, but not least, judgment and humanitarian considerations in the management of labor.

Changing Views on Management

A paragraph from a recent address by Walter S. Gifford, the young new president of the American Telephone and Telegraph Co., summarizes this trend in admirable style: "The character of management is changing. The captain of industry of not so long ago was a pioneer and could very properly be likened to the pioneers who cleared the forests and



Above—Relative yearly average prices of lime and calcined gypsum, 1914 to 1925. Below—Relative production of lime and calcined gypsum in tons, 1914-1925

blazed trails through unknown regions. Today, while, of course, leadership, courage and vision are needed, the very size of business undertakings necessitates a more deliberate, careful type of management. Because of the size of modern business units, a mistake in plans or design or specifications might result in very large losses. At the same time, management is probably not more, but less, hazardous than in the days of pioneering. This is because the nature of modern business makes judgment less speculative and based more on facts—statistical, technical and scientific."

Let us remember, then, that business and the public welfare are founded on a knowledge of facts, and upon the judgment with which such facts are interpreted and applied. We can all help in establishing and giving currency to facts affecting our industry.

The Portland Cement Industry in 1926

Production and Storage Facilities Are Overtaking Demand

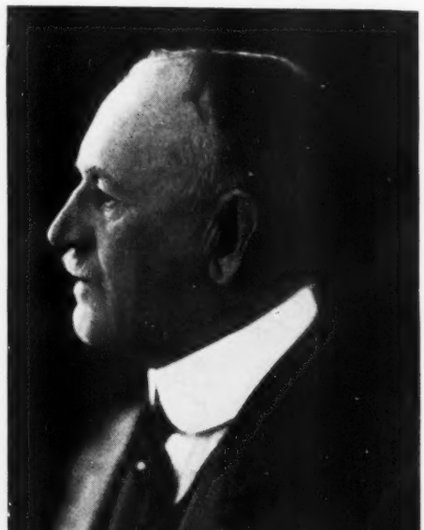
By Robt. W. Lesley
Philadelphia, Penn.

IN the spring of 1925, the United States Geological Survey figures showed a large stock of cement and clinker on hand, and it was stated that the indications were that the total demand for the year would not reach within 20% of the practical operating capacity of the industry, which was estimated at 180 million barrels for 1925. The figures for eleven months of 1925 show total shipments of 149,783,000 bbl., and if to this is added an estimated figure of 5,506,000 bbl., which was the figure for December, 1924, the total will be around 155,295,000 bbl., as against 145,747,000 bbl. for 1924. Taking this figure for shipments in 1925, it will be found that it is between 80 and 81% of the estimated operating capacity of the industry of 180,000,000 bbl., and a very close verification of the early spring figures of 1925 referred to above.

While the figures for shipments would indicate that the industry is operating upon a fair margin of capacity, a further examination shows that the stocks of cement and clinker on hand at the end of the month of November, 1925, aggregate 14,450,000 bbl.; and if the shipments for December, 1925, are at or about the same figure as for December, 1924, and the production about the same as the same month in 1924, these stocks on hand would aggregate practically 20,000,000 bbl. This would indicate that the production is very nearly overtaking the capacity and that there is evidently a potential production in excess of the demand. This overproduction is partially accounted for by new plants that have been constructed in various parts of the country during the year but is, to the mind of the writer, accounted for by a new development in the industry.

Up to a recent period, cement manufacturing has been a seasonable business; and in many cases, due to the closing down of building operations in winter time, cement mills have largely suspended manufacturing during the winter months. Lately, however, this condition has changed by the construction in many mills of large clinker storage pits and of large additional storage capacity in the way of new storehouses and storage silos. In consequence of this changed condition, enabling the mills to run full time all winter, a largely increased capacity has been created in many old mills without the actual construction of new plants. If this condition continues and is not taken into account where new mills are projected, it is only a question of a short time when the industry will show a very large increase of potential capacity, which will then become actually a cause of over-production to a great extent.

Another subject that is engaging the attention of producers and consumers of cement is the large and constantly increasing importation of foreign portland cement, especially along the Atlantic and Pacific coasts. In 1924 the imports were 2,010,936 bbl. The figures for the first ten months of 1925 show



a total of 2,970,525 bbl., and if the imports continue on the basis of the earlier months of the year, it is likely that a figure of 3,500,000 bbl. will be reached in 1925.

As against these facts there is to be considered the largely increased demand for concrete in its many forms, especially in the building of new roads and in the enormous development of the concrete building block. It is a matter of gratification to see that for the first time the new road construction has passed the hundred million yard mark; and this, with the natural increase in the yardage for December, may mean the use of nearly thirty million barrels of cement in 1926, in this field alone.

The farmers' prosperity is expected to largely increase the 21% of the total output of cement that normally goes for miscellaneous farm purposes, while the use in sidewalks and private driveways will also show increases. Railroad development, house building and other construction, shown by the building permits applied for in the late months of 1925, indicate also largely increased consumption.

The year 1925 was marked by a number of outstanding events in the cement industry. First and foremost was the decision of the United States Supreme Court in the case of the Cement Manufacturers' Protective Association, the Atlas Portland Cement Co., et al. vs. the United States. This important decision was the result of prolonged litigation and is now a leading case among lawyers dealing with litigation under the Sherman anti-trust act; by its authorization of the circulation of proper trade information among members of a given industry through its own organization, its effect has been widespread in the United States among trade organizations of all kinds and will be of the greatest benefit to industry generally in the United States.

The corner-stone laying of the new building of the Portland Cement Association in Chicago was a feature of the annual meeting of that organization in November, 1925. In this building will be housed the scientific laboratory of the association, which is operated in connection with the Lewis Institute; and there will also be several floors devoted to the Administrative, Accident Prevention, Advertising, Cement Products, General Education, Conservation, Railways, Highways, and Structural Bureaus. The new building will be of concrete and cost over $600,000.

The year was also marked in science by the increased use and development of the water ratio of concrete, as originated by Professor Abrams, of the Lewis Institute Laboratory; by the work of Committee C-1 of the American Society for Testing Materials with its recently issued manual of cement testing and its suggested substitution of neat tests for cement at 24 hours for long-time tests of 3 to 1 mortar; and by the further work of the joint committee of the various engineering societies on concrete and concrete specifications.

All these developments naturally relate to the use of concrete by the consumer. On the other hand, through its conservation committee, the Portland Cement Association has developed many improvements in the greater

economy in grinding and burning of cement; while through the creation of its fellowship in the Bureau of Standards, it has inaugurated, in co-operation with a committee of the American Society of Civil Engineers and the United States Bureau of Standards, a most thorough investigation into the constitution of portland cement, in which the latest developments in the chemical and physical sciences are being applied to the obscure question involving the real constitution of portland cement, as distinguished from its chemical composition.

The general public's interest in concrete, its many uses, its permanent, fireproofing, structural, and other valuable qualities has been maintained during the year by lectures before colleges, engineer clubs and other organizations. In addition to all this, there have been many papers of the greatest technical value read and discussed at the meetings of the leading engineering societies of the country, and a great volume of material in the engineering, technical and lay press.

A Year of Great Development in Production, Financing and Manufacturing Processes

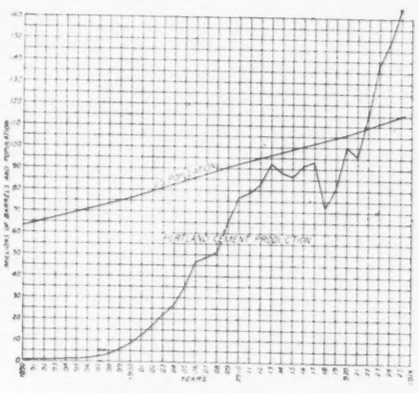
OUR records show that there were in 1925 some 30 new incorporations which are manufacturing, or are proposing to manufacture, portland cement. The total capitalization of these was close to $100,000,000. Of course this includes a number of capital increases, refinancing, or reorganization, by going corporations due to absorption of existing companies and expansion of old concerns through newly organized subsidiaries or holding companies. We believe that at least a third of this sum represents actual capital invested in new projects during the year. Since Rock Products began the publication of its "Financial News" pages on March 21, 1925, $32,000,000 in portland cement securities have been sold to the public by old established portland cement manufacturers.

One of the most significant things about the tremendous increase in productive capacity during 1924, noted in Mr. Lesley's review, is that the greater part of it is due to the expansion of old established manufacturers. The International Cement Corp. has completed a new mill at Norfolk, Va., having a capacity of 1,200,000 bbl.; the Clinchfield Portland Cement Co., its plant at Clinchfield, Ga., with an initial capacity of about 700,000 bbl. and with a third kiln afterward installed about 1,000,000 bbl.; the Trinity, its new mill at Fort Worth, Texas, with a capacity of 500,000 bbl.; the Peerless, its Detroit, Mich., plant, 1,200,000 bbl.; the Southwestern, its Osborn, Ohio, plant, 1,200,000 bbl.—a total of five new plants and a total capacity of 5,000,000 bbl. One new concern, the Standard Portland Cement Co., Cleveland, Ohio, entered the field with a 800,000 bbl. plant at Fairport, Ohio. The total productive capacity added by these new plants is nearly 6,000,000 bbl.

Additional manufacturing capacity was added to existing plants either through the addition of more kilns, raw material, clinker or finished cement storage facilities to the extent of at least 7,000,000 bbl. more; or the total addition to the portland cement manufacturing capacity of the United States in 1925 was not less than 13,000,000 bbl.

How Existing Plants Are Rapidly Expanding

Typical, although probably not complete, is the following chronological record of such additions to existing plants: ***January,*** Glens Falls Portland Cement Co., building 100,000 bbl. storage for cement; Petoskey, doubling output (750,000 bbl.); Missouri, adding two new kilns (700,000 bbl.); Marquette, increasing capacity of Cape Giradeau, Mo., plant 50% (300,000 bbl.); Crescent, modernizing through installation of electrical equipment; National, enlarging Ragland, Ala., plant (300,000 bbl.). ***February,*** Universal installing Cottrell electrical dust-collecting system at Buffington, Ind., plant; Atlas building a gypsum rock plant at Watonga, Okla.; Phoenix (now Alabama subsidiary of International), increasing capacity one-third (300,000 bbl.) ***March,*** Dixie reconstruction



Population increase in the United States and portland cement production compared

and electrification at Richards city, Tenn.; Phoenix (now Alabama) adds fourth kiln (300,000 bbl.); Gulf States to install new kiln at Demopolis, Ala. (250,000 bbl.); Bessemer building new silos (175,000 bbl.); Giant making extensive improvements at Egypt, Penn.; Utah spending $200,000 lengthening kilns and changing to wet process; Signal Mountain, new kiln being installed (300,000 bbl.) ***April,*** Southwestern to build gypsum rock plant at Alamogordo, N. M. ***June,*** Ash Grove, lengthening kilns at Chanute, Kans., from 125 to 200 ft. (250,000 bbl.); Aetna, doubling capacity at Bay City, Mich. (300,000 bbl.); Atlas expands its land holdings in Monroe County, Pennsylvania; Monarch, new tube mill and electrical equipment at Humboldt, Kans. ***July,*** Missouri increases land holdings at Sugar Creek, Mo.; Alpha adds (150,000 bbl.) storage for cement at Manheim, W. Va. (275,000 bbl.) storage at Martins Creek, W. Va.; Superior installs aerial tramway for handling stone from quarry to plant; Monolith increases capacity (300,000 bbl.). ***August,*** Superior adding new kiln (300,000 bbl.); Monolith changes from oil to natural gas fuel; Colorado spending $500,000 on improvements at Portland, Colo. (250,000 bbl.). ***September,*** Giant adding (200,000 bbl.) storage (cement and clinker) at Egypt, Penn. ***October,*** Phoenix increasing cement storage of Nazareth, Penn., plant (100,000 bbl.) and adding new kilns (600,000 bbl.); Lawrence, increasing cement storage at Siegfried, Penn. (250,000 bbl.); Nazareth, increasing storage at Nazareth (80,000 bbl.); Warrior (formerly Gulf States) adding (110,000 bbl.) storage at Demopolis, Ala.; Petoskey to double storage capacity at Petoskey, Mich. (150,000 bbl.); Louisville increases storage capacity at Speed, Ind. (100,000 bbl.); Sandusky doubling storage capacity at Bay Bridge, Ohio, plant (100,000 bbl.); Atlas installing new kiln at Leeds, Ala. (250,000 bbl.); Acme, at Catskill, N. Y., adding storage (150,000 bbl). ***November,*** Olympic, Bellingham, Wash., adds new kiln (300,000 bbl.); Hercules building new storage and packhouse (100,000 bbl.); ***December,*** Beaver, Gold Hill, Ore. (50,000 bbl.); Old Mission, San Juan, Calif. (750,000 bbl.).

In addition to the above, which are based largely on news reports in Rock Products, verified by correspondence in most cases, we also have been informed of the following increases in storage capacities: Peninsular (50,000 bbl.), rock storage and clinker storage added at Cement City, Mich., plant; Golden State (78,000 bbl.), cement storage added at Oro Grande, Calif.; Manitowoc, slurry storage added at Manitowoc, Wis. (46,000 bbl.).

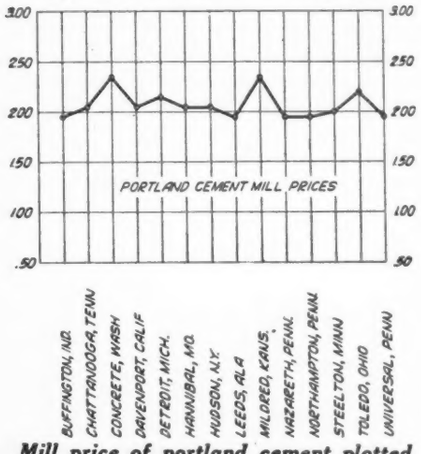
A summation of this probably incomplete list of plant expansions in 1925 gives an added manufacturing or storage capacity of over 8,000,000 bbl. While the increased storage facilities included above do not add to the potential producing capacity of the plants, they do add materially to the possible producing capacity by increasing the length of the operating season. It is true, doubtless, that the "producing capacity" of the

industry has always been 20% or more in excess of shipments, but many plants could not have developed their full capacity under the seasonal demands, for want of adequate storage. In a number of instances now storage is provided for almost 25% of the yearly production, which certainly ought to make possible almost 100% of the potential producing capacity of the plants.

This increase in winter production of portland cement is strikingly shown in the accompanying chart, in which monthly production of portland cement is plotted in percentage of the corresponding month in 1919 considered as 100. This is compared with the monthly production of 22 basic commodities (including cement) on the same basis of 100 for corresponding monthly production in 1919.

Under Construction and Projected

Besides the six plants completed and put into operation in 1925, some 22 plants are



Mill price of portland cement plotted against point of origin

now in various stages of construction, or are projected, and likely to be built in 1926: the Wabash at Osborn, Ohio (700,000 bbl.); Ideal at Fort Collins, Colo. (700,000 bbl.); Lehigh (old Alsens plant being rebuilt) at Alsens, N. Y. (700,000 bbl.); Lehigh at Bath, Penn. (700,000 bbl.); Lehigh at Ocala, Fla. (700,000 bbl.); International at New Orleans (700,000 bbl.); Wyandotte at Bay City, Mich. (700,000 bbl.); Calaveras, San Andreas, Calif. (700,000 bbl.); American, Imperial, Calif. (300,000 bbl.); Idaho, Lewiston, Idaho (300,000 bbl.); Linwood, Davenport, Iowa (600,000 bbl.); Florida at Tampa, Fla. (700,000 bbl.); Ocala, Ocala, Fla. (1,000,000 bbl.); Adam L. Beck's projected plant at Buffalo, N. Y. (1,500,000 bbl); Boyne City, Boyne City, Mich. (700,000 bbl.); Southland, Chattanooga, Tenn. (300,000 bbl.); Yosemite, Fresno, Calif. (300,000 bbl.); Peralta, San Mateo, Calif. (600,000 bbl.); Mid-Continental, Oklahoma (1,000,000 bbl.); Gaudalupe, San Jose, Calif. (1,000,000 bbl.); Arkansas, White Cliffs, Ark. (700,000 bbl.); Santa Rosa, St. Stephens, Ala. (1,200,000 bbl.).

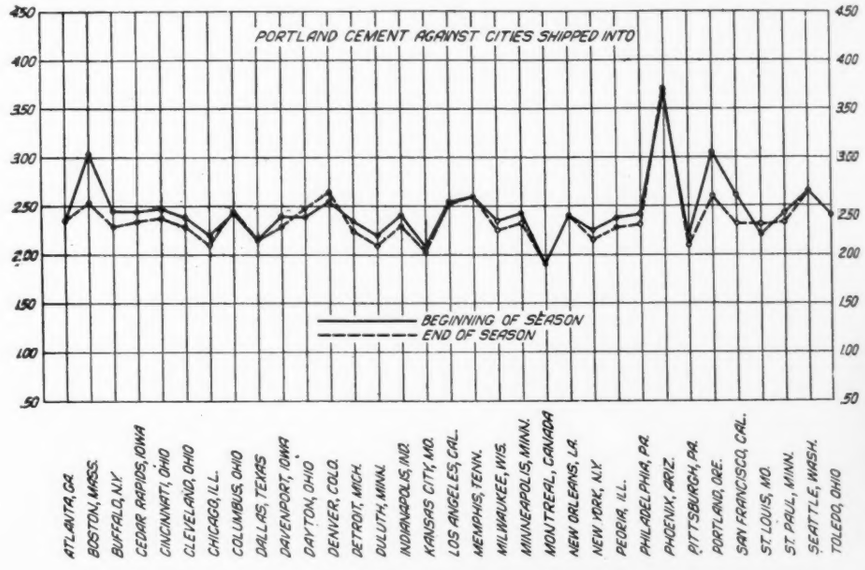
Enough work has been done on all the above projects to give reason to believe that at least half of them will begin to produce in 1926—one-half the total of 16,000,000 bbl., or 8,000,000 bbl., not taking into account the additions contemplated at existing plants. Of course, in the above tabulation most of the capacities are estimated without accurate knowledge of the actual initial capacities contemplated, but we believe conservatively estimated. We believe we are safe in saying there is enough projected producing capacity in sight for 1926 to bring the possible production up to 200,000,000 bbl., or 25% more than shipments this year—the greatest in history.

Becoming More and More Local

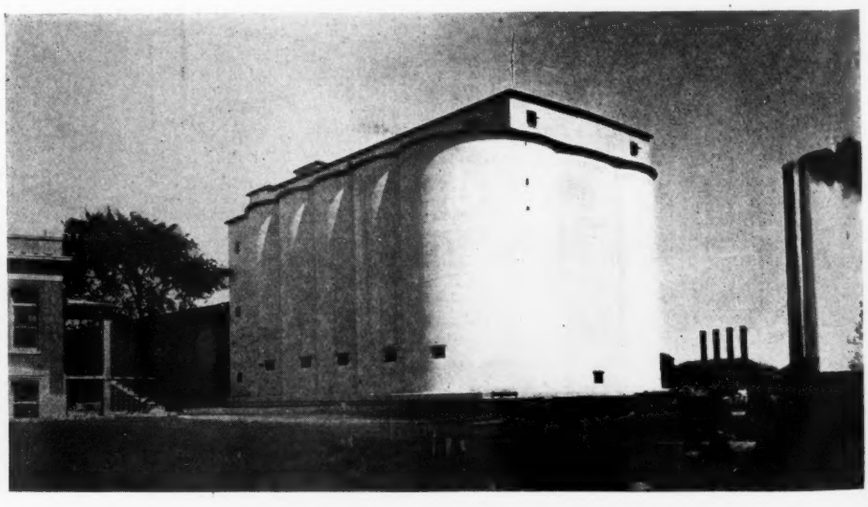
It is doubtful if there is any other industry of equal size, manufacturing a transportable basic commodity, of such a purely local character as the portland cement industry is fast becoming. Every year the shipping radius of the older plants becomes narrowed by new ones fringing its territories; yet in spite of these constantly restricted sales territories, the growth in consumption has been so remarkable that groups of plants like that in the Lehigh Valley, which in 1897 produced 75% of all the portland cement made in the United States, and shipped from coast to coast (as recently as 1918 it produced about 30% and shipped to nearly all points east of the Mississippi river)—even in the Lehigh Valley—the industry has continued to grow and prosper.

All conditions the past year have been peculiarly favorable to the promotion of new projects. There has been an overflowing money market, there has been sharp competition between the big companies for the plants of some of the smaller companies; prices reported to have been paid for these plants have undoubtedly made it look profitable to build new ones with the same object in mind. There is plenty of evidence on every hand of constantly increasing competition for quality and prestige on the part of the big companies with more or less national distributing facilities.

The competition for strategic locations near great consuming centers is also marked. Of course, there are few big cities with raw

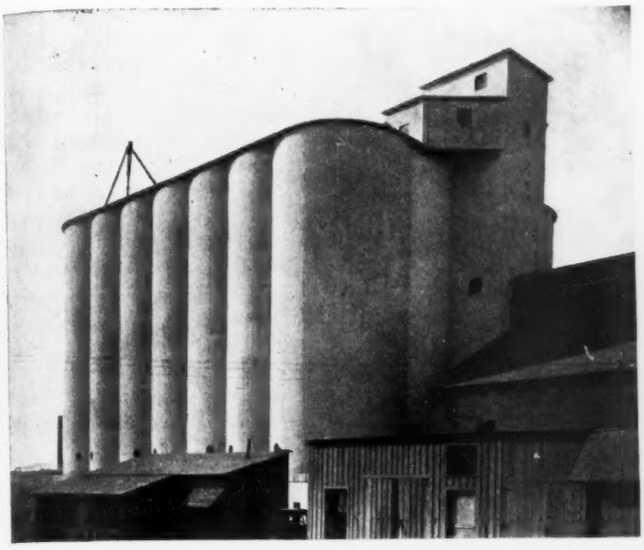


Portland cement net prices plotted against principal consuming cities

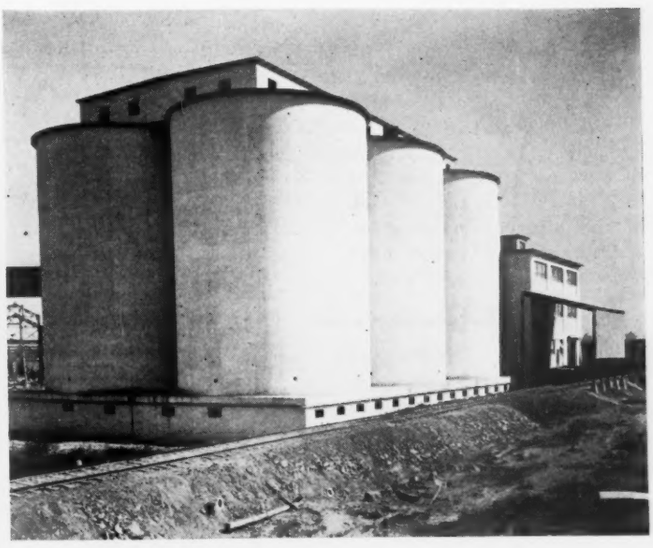


New silos for cement at the Glens Falls Portland Cement Co. plant, Glens Falls, N. Y.

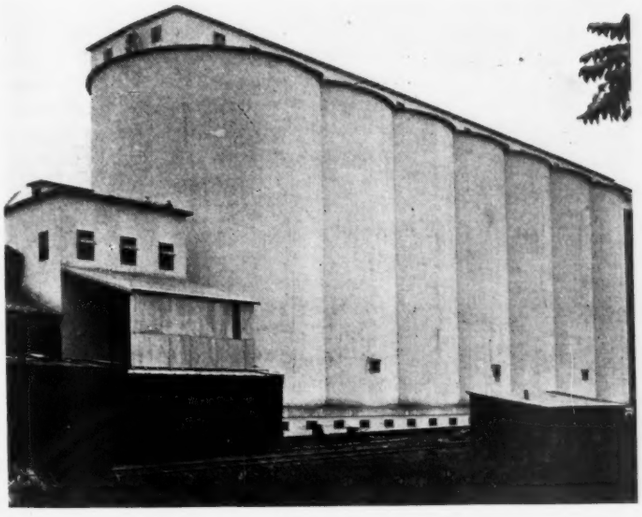
How Established Cement Plants Are Increasing Manufacturing Capacities by Providing for Longer Operating Seasons



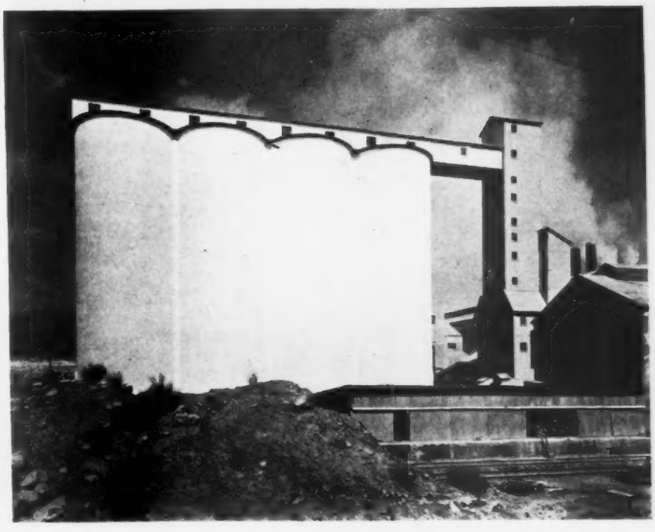
Northwestern States Portland Cement Co., Mason City, Iowa



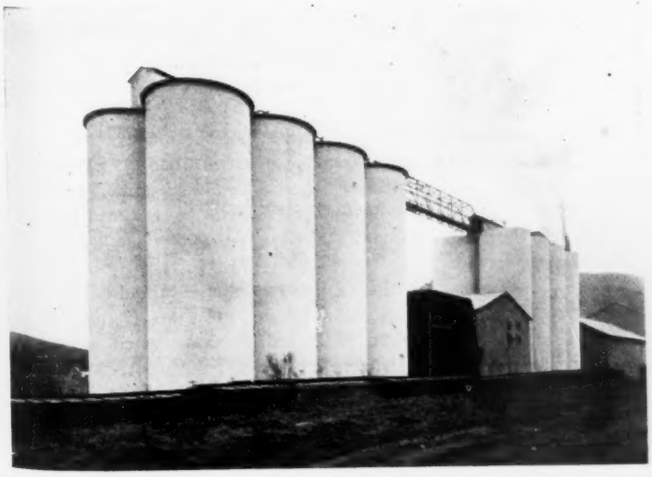
Marquette Portland Cement Co., Cape Girardeau, Mo.



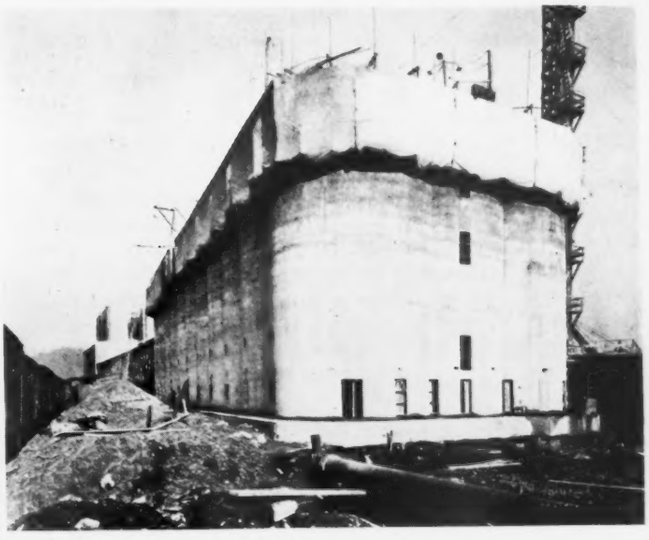
Bessemer Limestone and Cement Co., Walford, Penn.



Golden State Portland Cement Co., Oro Grande, Calif.



Old Mission Portland Cement Co., San Juan, Calif.



Alpha Portland Cement Co., Martins Creek, Penn.

Views by courtesy of the MacDonald Engineering Co., Chicago, construction engineers

materials close enough at hand or where transportation is cheap enough to supply cement mills, but where these raw materials are to be had, as at Norfolk, New Orleans, Tampa, San Francisco, and around the Great Lakes, there is most interesting and active competition, which has led to the construction of cement factories like that of the Peerless Portland Cement Co., Detroit, entirely unknown to the industry of 10 years ago—modern city factories in every respect. One of the features of this plant is the provision for sacking and for shipping 1000 bbl. of cement per hour by motor trucks alone.

Technical Developments

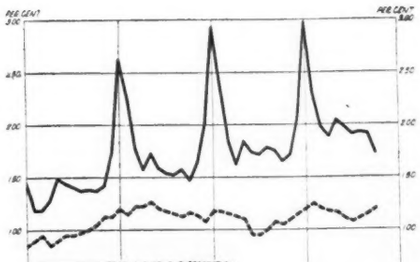
All of the new cement plants completed in 1925 are wet-process plants. One of the new ones now under construction, that of the Ideal Portland Cement Co. at Fort Collins, Colo., is to be dry-process. The others under construction or projected so far as we know now, including the new Lehigh plant at Bath, Penn., will be wet process. This plant is of particular interest because it will be the first invasion of the wet process into the Lehigh Valley, the stronghold of the dry process for many years.

Three of the new wet-process plants constructed in 1925 have waste-heat boilers. (We do not know the details of the Virginia plant at this writing.) At the Peerless plant the kilns are 11x175 ft.; at Clinchfield, 10x 175 ft.; at the Southwestern, 11 ft. 6 in. x 175 ft. We assume, therefore, that 175 ft. has been determined upon as about the correct length of a wet-process, waste-heat kiln. The first waste-heat kilns in a wet-process plant especially designed to utilize waste heat (Petoskey) are 10x150 ft.; those at Manitowoc are 10x160 ft. The two kilns at Petoskey have been reported to have produced over 700,000 bbl. in a year, and over 1600 bbl. each in 24 hours. The two wet-process plants without waste-heat boilers have kilns 10x240 ft. (Standard) and 11 ft. 6 in. x 250 ft. (180 ft. has 10 ft. diam.) (Trinity).

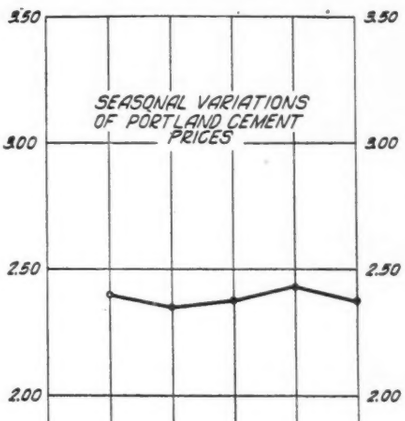
For grinding, the evident tendency is toward very large compartment mills. Those at the Peerless plant are 7x26 ft., 3-compartment on the raw side and 8x26 ft. on the finish side. The Southwestern has 8 ft. 6-in. x 28 ft. raw mills and two 7x26 ft. and one 6 ft. 6-in. x 40 ft. mill on the finish end, the latter being probably the largest tube mill in the United States.

The use of overhead traveling cranes with clam-shell buckets for handling raw materials from storage to mills or feeders was adopted at all the new plants, and is now apparently the universally accepted method. The size of the cranes used for this purpose varies from 6 to 16 tons and the size of the bucket from 2½ to 4½ yd. This size, of course, is dependent on the speed and length of travel of the crane, as well as the number of kilns to be fed in the ultimate development of the plant.

The use of speed reducers and direct-connected drives is now practically standard, having been widely used at all new plants constructed in the past two years. Much progress has been made in the details of electrical equipment, but both the synchronous motor with magnetic clutch and the super-synchronous motor were used with apparently equal favor in the new plants for tube-mill and compeb-mill drives.



Graph showing monthly production of 22 basic commodities (including portland cement) in percentages of same month in 1919 as 100 and monthly production of portland cement alone on same basis



Seasonal variation in average portland cement prices

One of the outstanding developments of the year (an Australian visitor told us the most important development in the cement industry in several years) is the adoption of the Fuller-Kinyon pump for handling both pulverized coal and cement. The first installation of this kind for handling finished cement, in place of the time-honored screw conveyor, was at the plant of the New Egyption Portland Cement Co. described in Rock Products, April 4, 1925. They are also used in the new Standard and Southwestern plants for cement as well as coal. (On another page of this issue is an article by the inventor of this device describing it and its development in detail.)

Prices and Future Outlook

Reports from 30 representative portland cement manufacturers show individual increases over 1924 production by 65% of the producers ranging from 1 to 70%, with an average of 21%. Some 18% report the same production as 1924, and 17% report decreases compared with 1924 ranging from 5 to 18%, with an average of 10%. The averaging of these reports gives a 10% increase in production for the industry as a whole, which tallies with the U. S. Geological Survey figures for the first 11 months of the year plus our estimate for December (11,500,000 bbl.) —a total of 162,000,000 bbl. in 1925 against approximately 149,000,000 in 1924—an increase of slightly less than 10%. However, probably about 20,000,000 bbl. of 1925 production will be in stock on January 1, 1926, as against about 17,000,000 bbl. on January 1, 1925.

Prices in 1925 were reported lower than prices in 1924 by 45% of the manufacturers. Decreases ranged from 3 to 20% with an average of 9%. The greatest decreases, in every instance, were on the west coast. About 10% of the manufacturers reported slight increases in prices (0.4 to 2.4%), an average of 1.4%; and 45% reported no change in prices compared with 1924. The average decrease in prices in 1925 for the cement industry as a whole was about 4½%, which checks with the decrease shown in our current price quotations.

The outlook for 1926, in the opinion of representative producers, is for an average increase in production over 1925 of 20%, based on increases ranging from 5 to 160% by more than half of the producers and decreases of 10% by only two producers; about half of the producers expecting the same amount of business as in 1925. As to prices in 1926, some 14% look for decreases of from 5 to 10%; one producer looks for a price increase of 10%. The average anticipated decrease in therefore about 1%, taking into account 85% who look for no appreciable change in prices.

Pertinent Paragraphs from Producers

"Conditions along North Atlantic seaboard seem to be fairly sound."

* * *

"Odds are against the pessimist—for two years more—but his danger signals may be nearer than we think (Pennsylvania)."

* * *

"Feel that the consumption will be slightly larger in 1926 than in 1925. But also feel that in some sections on account of increased production prices will be lower (Pennsylvania)."

* * *

"Indications from the administration at Washington point to a larger amount of public works to be constructed next year than were constructed during 1925, and that large appropriations for this purpose will be requested by Congress. On the whole, 1926 should be a very favorable year for our industry."

"In our locality we look for more building in 1925. Highway construction will be about the same as 1925—maybe a little better (Ohio)."

* * *

"Overproduction in Ohio."

* * *

"This country is still young—still growing. If we can keep our feet on the ground and our heads on our shoulders, we have a long way to go to reach the peak (Michigan)."

* * *

"Poor business in this territory (Far Northwest). May get better."

* * *

"For the past four or five years crops have been rather poor throughout territory (Rocky Mountain-Northwest), but this season they had bumper crops. We expect 1926 will show considerable activity in farm and small-town construction, and possibly some public works. No concrete highway construction in prospect."

* * *

"Large public works program in Oregon will make 1926 a good year."

* * *

"Volume of business in 1925 has been very satisfactory, but prices have been low, to a considerable extent due to the importation of cheap cement from Europe. The importation of cement is being curbed because of the dissatisfaction with these cements (California)."

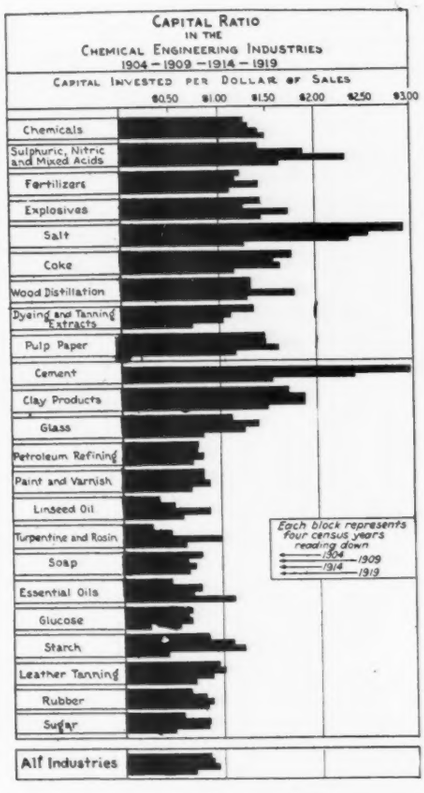
Portland Cement Industry as an Investment

According to the accompanying chart, which is reproduced from an article in the November issue of *Chemical and Metallurgical Engineering* by C. R. De Long, chief of the chemical division, U. S. Tariff Commission, the capital ratio of the portland cement industry in 1919 was about $1.55, while the average of all manufacturing industries was $0.71.

Capital ratio is explained as the relation of capital invested to the value of the products produced. (That is, for every $2 barrel of cement manufactured, $3.10 was invested in cement plants.) It is of course desirable, and a mark of efficient management to keep the capital ratio the lowest possible. Mr. De Long points out, with partciular reference to the chemical industries, the necessity of constant striving to reduce the capital ratio, which was an average of $1.49 in 1919 to a possible goal of $1. He says some of the places where idle capital may be found are: (1) Excessive credits or accounts receivable; (2) overgrown inventorie of both raw materials and finished products; inefficient utilization of factory space; (4) inefficient or obsolete mechanical equipment.

Apparently the portland cement industry has a relatively high capital ratio, which is proof that the average price of portland cement is as low as consistent with good business management, for the industry as a whole. Of course, at individual plants the capital ratio may be considerably more or less than the $1.55 average for the industry as a whole.

The latest figures available are for 1919, when the average mill price of portland cement was $1.71. In 1925 the average mill price was approximately $1.95 per bbl., an increase of about 13%, whereas the various machinery items which go to make up a cement mill must certainly have increased in a greater ratio, as have most certainly other construction materials and construction labor.



Capital ratio in the portland cement industry compared with various chemical industries and with the average of all industries. (Reproduced from "Chemical and Metallurgical Engineering" by special permission)

The characteristics of portland cement manufacture are those of a standard commodity of apparently steady, continuous demand in large quantities, which justifies a lower return on invested capital than in a manufacturing industry subject to more fluctuating demands, or to radical changes through sudden commercial or manufacturing developments. But it would seem that the average return on invested capital as compared with other industries does not justify any stampede to invest in new cement mills.

Cement and Iron

(An editorial in "Iron Age," December 17)

CONSUMPTION of portland cement makes a new high record this year by about 7%, following sharp increases in 1922, 1923 and 1924. Nevertheless the long range comparison shows that cement has not been gaining in the past 10 years at anything like its rate in the preceding 10 years. Perhaps cement is beginning to show what other industries have shown, that a very rapid growth is possible up to a certain point, when the activity becomes so large relative to the general activity of the country that a more moderate pace must follow. High geometric ratios of growth are impossible of indefinite continuance, for otherwise a given thing would in time crowd out everything else.

Assuming portland cement shipments this month at the mean of the two preceding Decembers, shipments by quarters compare as follows in two years:

PORTLAND CEMENT SHIPMENTS
(Barrels)

	1924	1925
First quarter	20,138,000	21,456,000
Second quarter	42,358,000	48,630,000
Third quarter	50,296,000	54,225,000
Fourth quarter	32,955,000	*31,435,000
Year	145,747,000	155,746,000

*Partly estimated.

Unlike iron and steel, portland cement had a backset during the war and through 1919, and this may account for the rapid increase since, hence this year may be taken as normal for these times. Taking for a 10-year comparison the average of 1914-5-6, there is a gain of 75.9% in 10 years, equal to 5.8% annually. In the preceding 10 years, taking the 1904-5-6 average as a basis, there had been 145.4% increase, or an average of 9.4% annually.

Thus the annual percentage rate of gain in the past 10 years has been less than two-thirds of that in the preceding 10 years.

The rate of pig iron gain slowed down earlier, just as would be expected, for iron is a much older material, in point of general industrial use, than cement. The Abram S. Hewitt rule of pig iron doubling in 10 years held out very well until early in the present century, say until some time after 1906. From 1905 to 1925 pig iron has increased only 69%, while cement has increased 332%, taking for each commodity the mean of 1904-5-6 to represent 1905.

The bare figures would suggest confirmation of the fears felt some 20 years ago that concrete would interfere with the growth of iron and steel consumption, acting in a way as a substitute; but consideration of all the circumstances indicates otherwise. The usefulness of concrete as a construction material has tended to stimulate construction. It would be idle to assert that men would be doing as much today in any line of endeavor as they are doing, if it were much harder to do the things. In many cases cement has been an aid rather than a hindrance to the expansion of iron and steel consumption. The divergence in the figures of growth is due to the general principle that no activity can increase indefinitely in a much greater geometric ratio than the population increase.

The Crushed Stone Industry in 1925

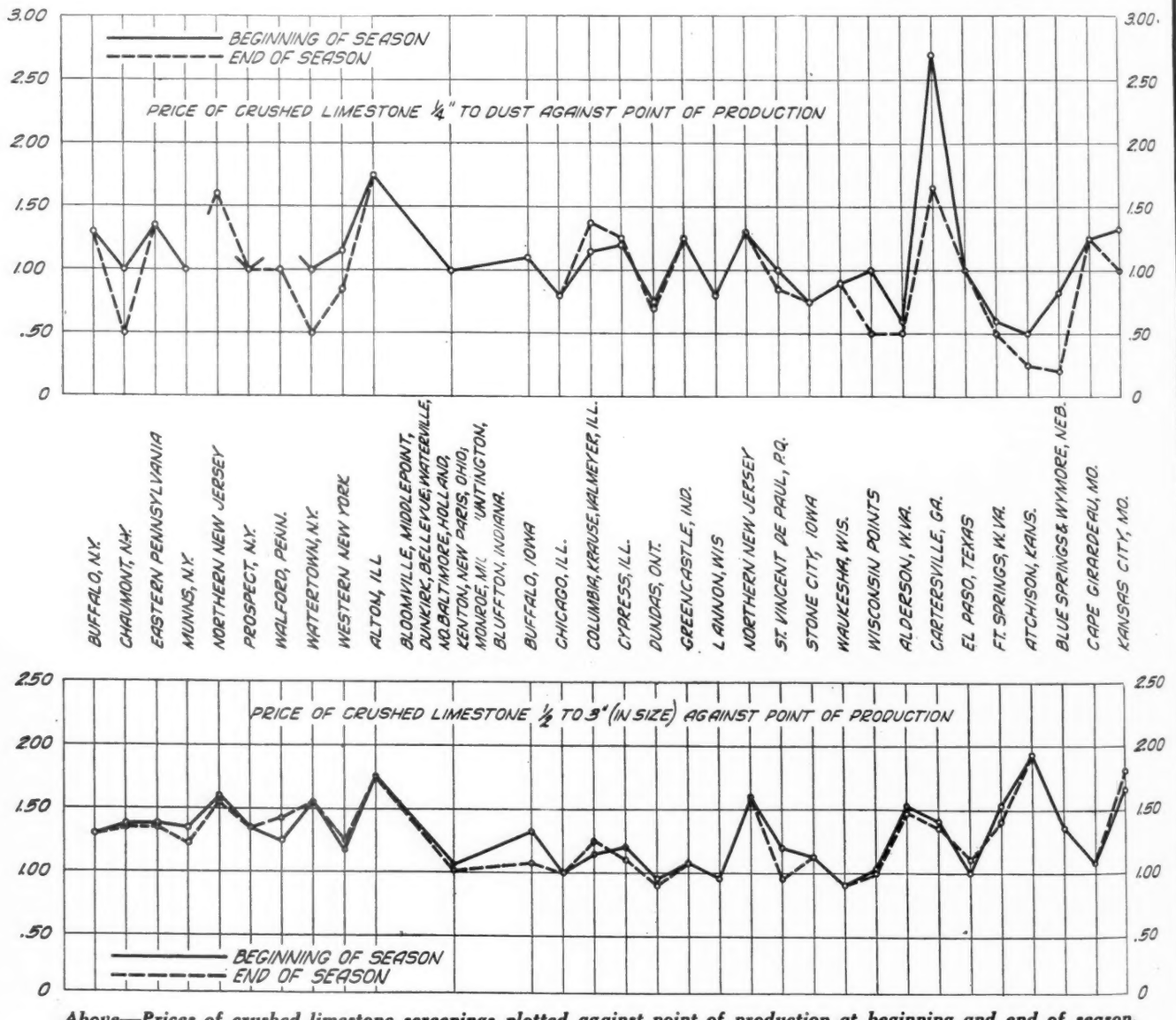
Reorganization of National Crushed Stone Association—Notable Plants — Progress Toward Stability Evidenced in Many Ways

THE OUTSTANDING development in the crushed-stone industry in 1925 was unquestionably the reorganization of the National Crushed Stone Association. We doubt if any other event of the year will have such great and lasting influence on the quarry industry. It marks the first organized attempt of quarrymen to teach crushed-stone users the proper use of this commodity.

There is no question that all the rock products industries (and many others as well) have learned much from the Portland Cement Association. It will doubtless more and more serve as a model for trade association activities. The outstanding accomplishment of the Portland Cement Association is close co-operation with the user of cement to assure that each piece of construction shall be creditable to cement, when it is completed.

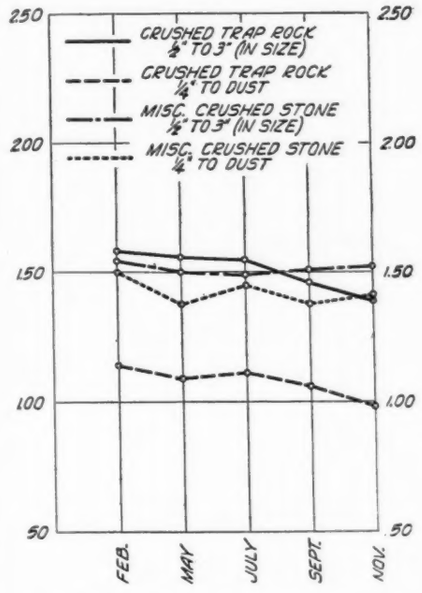
This exploded the old theory, still clung to by many producers, that the producer's responsibilities end when he has met the consumer's specifications. Successful modern business means an extension of the producr's service and expert knowledge of his product up to the moment it is incorporated in the finished structure, whether it be a concrete building tile or a monument like the "Fountain of Time:"

The leaders of the crushed-stone industry now recognize this, and it probably means, eventually, the rescue of the broken-stone type of road from the discard, toward which it was headed because of rotten workmanship and neglect of the elementary principles of sound construction. For while crushed-stone producers are now organized to fight the battles for their material as a concrete aggregate, they have been assured by highway au-

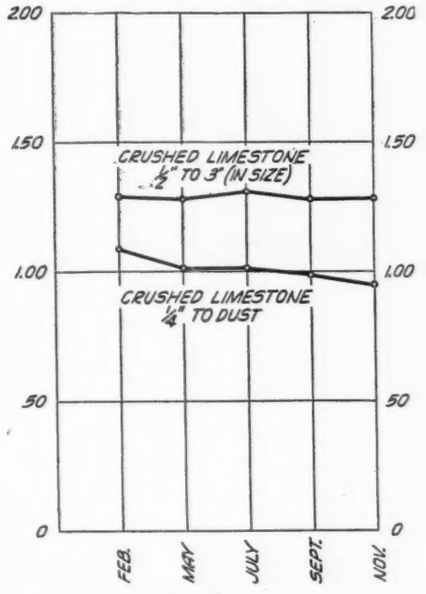


Above—Prices of crushed limestone screenings plotted against point of production at beginning and end of season. Below—Prices of commercial crushed limestone plotted against point of production at beginning and end of season

thorities, as of course they themselves have long recognized, that crushed stone roads *can* be built which will give long and satisfactory service on many miles of highway where it may not be economical to build concrete pavements for many years to come.



Seasonal variation in average prices of various kinds of crushed stone



Seasonal variation in average prices of limestone, crushed and screenings

Concrete Aggregate Problems to Be Investigated

Some of the immediate problems which A. T. Goldbeck, director of the engineering bureau of the National Crushed Stone Association, has said would be tackled first are:

(1) A study of the proper proportions of concrete as influenced by the grading of the aggregate.

(2) A study of the yield of concrete depending on the kind of coarse aggregate.

(3) The uses for stone screenings.

(4) A study of the possible uses of stone dust.

(5) A study of grading to promote: (a) The greatest workability and ease of finish; (b) greatest yield of concrete for a given quantity of stone; (c) greatest strength.

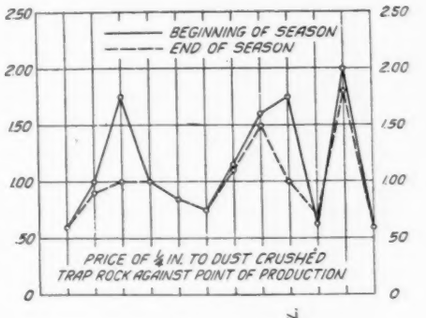
Outlines of researches are likewise under preparation looking toward the gaining of useful facts about the relation the character of the aggregate bears to resistance of concrete, to repeated loads, to alternate freezing and thawing, to direct tension, and to cross-bending both under dry and wet conditions of exposure.

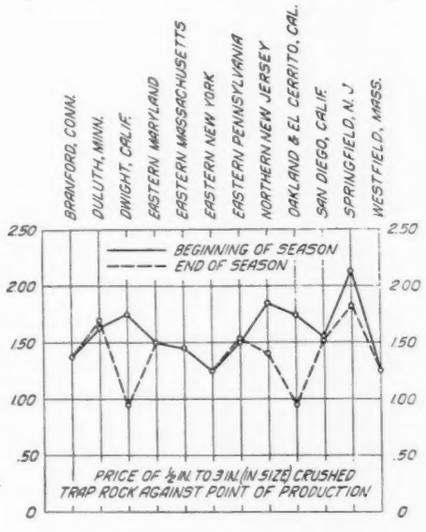
General Conditions

The crushed-stone industry in 1925 was extensively "spotty." Some 53 representative producers reported increases in production over 1924 of from 2 to 200%—the average increase of the 53 being 28%. Some 32 producers reported decreases over 1924 production ranging from 5 to 60%, with an average decrease for the 32 of 24%. A large number reported no change in production as compared with 1924. The balanced average is 7% increase over 1924 production which was 95,000,000 tons. The estimated production in 1925 is therefore 102,000,000 tons. All branches of the stone industry—railway ballast, highway stone, and furnace flux—showed increases, according to our estimates. Probably this will be the first year that production has exceeded 100,000,000 tons.

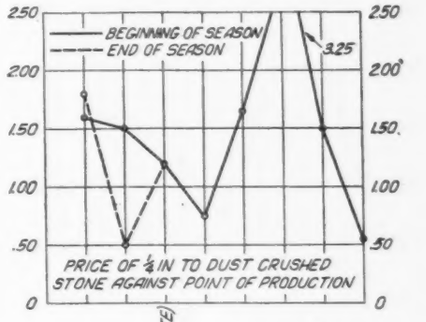
Eighteen producers reported increases in prices over 1924 prices ranging from 1 to 25%, with an average of 9%; 37 reported decreases ranging from 1 to 20%, with an average of 9%. Including a great many who reported little or no change in price as compared with 1924, the average decrease in price for the industry as a whole was about 1.5%.

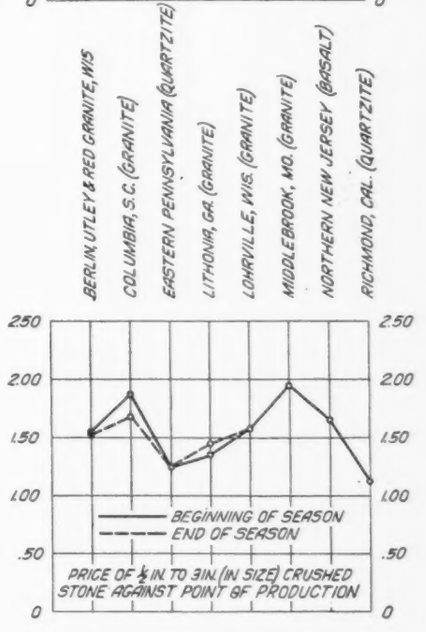
Apparently production varied with extremely variable local conditions; hence the industry was "spotty." The only section of the country where reported decreases in production were not offset by increases is Florida, which consistently reported increases everywhere. In the Southwest, particularly in Texas, there was a considerable increase in production over 1924, which was a particularly poor year in that section. California showed fairly consistent reports of increased production, but in the Northwest



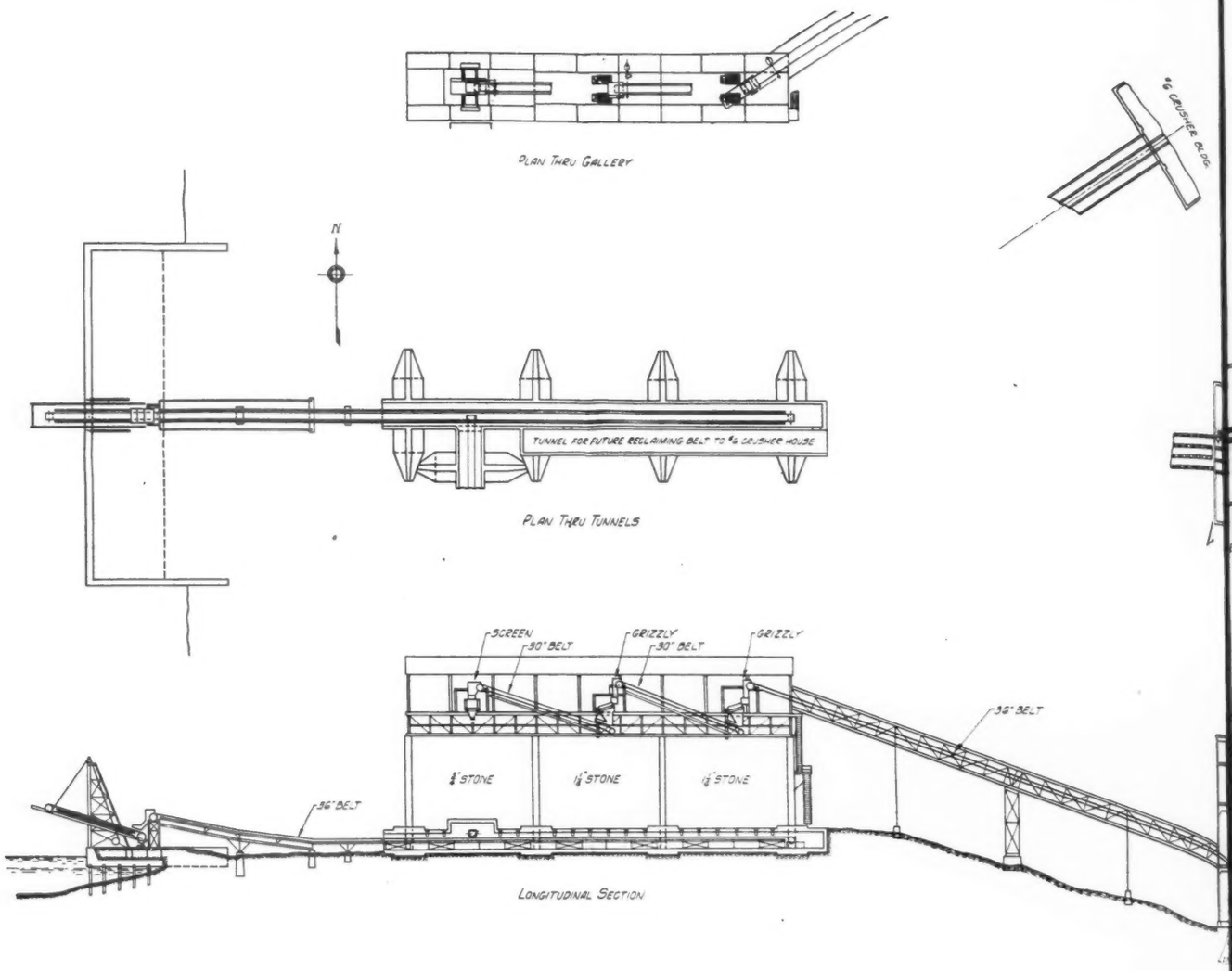


Trap rock screenings and commercial stone plotted against point of production




BERLIN, UTLEY & RED GRANITE, WIS.
COLUMBIA, S. C. (GRANITE)
EASTERN PENNSYLVANIA (QUARTZITE)
LITHONIA, GA. (GRANITE)
LOHRVILLE, WIS. (GRANITE)
MIDDLEBROOK, MO. (GRANITE)
NORTHERN NEW JERSEY (BASALT)
RICHMOND, CAL. (QUARTZITE)
BEGINNING OF SEASON
END OF SEASON
PRICE OF ½ IN. TO 3 IN. (IN SIZE) CRUSHED STONE AGAINST POINT OF PRODUCTION

Miscellaneous rock screenings and commercial stone plotted against point of production



General plan and elevation of the new Verplanck plant of the New York Trap Rock Corporation—Reproduc

General view of the new Verplanck, N. Y., plant of the New York Trap Rock Corp.

production hardly came up to 1924 figures. Price changes, as compared with 1924, were as various as changes in production. Prices were most stable in the Central West—Ohio, Indiana, Michigan, Illinois, and Missouri. Most of the price increases were in Florida and Texas, but even in Florida several producers reported no higher prices than 1924, although none reported lower prices.

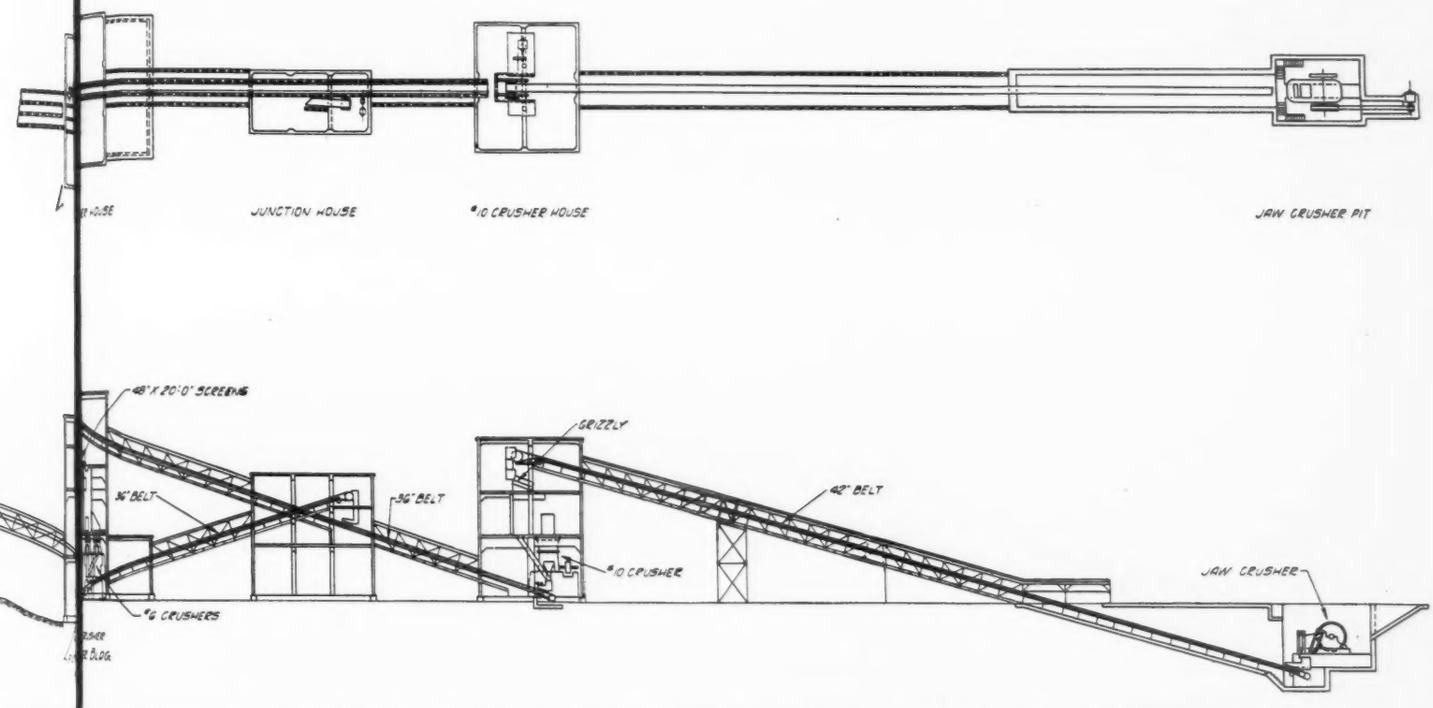
Outlook for 1926

Crushed stone producers in 1925 are certainly optimists on 1926. Sixty-eight representative producers predict increases in production varying from 3 to 500%. Most of the big increases are predicted in Florida. The average of the 68 producers is an increase for 1926 of 53%! Against this, nine producers see decreases, averaging 20%. The majority, however, see a production outlook for 1926 of about the same as this year, so that the average expected increase in production for the industry as a whole is approximately 28%. We believe these guesses are over optimistic and that a half of this figure, or about 14%, will represent a normal expected increase in production in 1926.

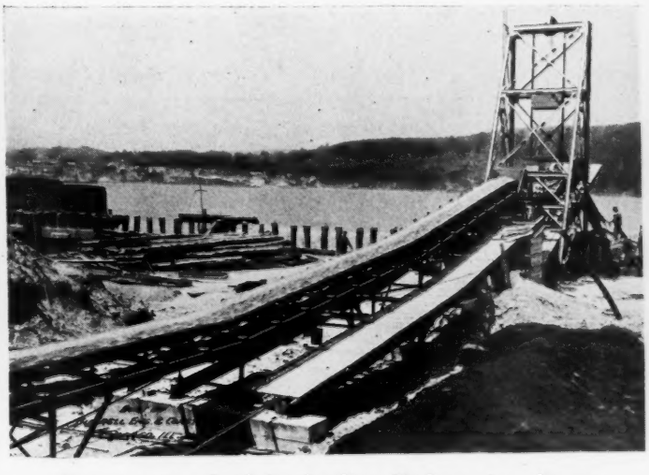
Similarly 25 producers see increases in prices in 1926 varying from 3 to 25%, the average being 12%. On the other hand, 14 producers see decreases in price ranging from 4 to 25%, the average being 11%. Taking into account the many who looked for prices to remain constant, the prediction of producers as a whole is a price increase during 1926 of a little over 1%. In other words, they look for prices to come back to approximately what they were in 1924. With this view we differ; we believe prices will continue downward 1 or 2% during 1926, and that this tendency will continue, under normal conditions, over a period of years to come.

Highway building and improvement accounted for by far the largest part of crushed stone production; general building and public works apparently took approximately the same amount of stone, with a less-than-normal railway ballast year. The railways have not yet begun to spend the sums for maintenance-of-way and improvements that have been expected year after year for the last few years.

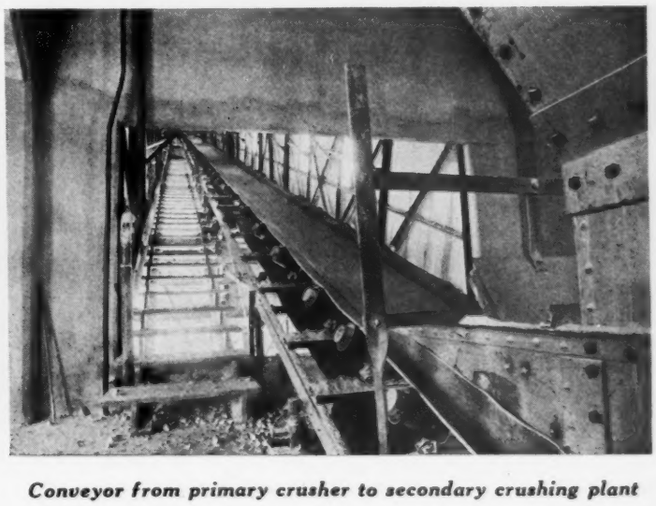
Opinion as to whether general building will be greater or less in 1926 is about evenly



Reproduced courtesy of the New York Trap Rock Corporation and the Burrell Engineering Co., designers and contractors



Conveyor to wharf for loading Hudson river barges



Conveyor from primary crusher to secondary crushing plant

divided. Apparently there will be as much or more industrial building. More highway work and public works generally are looked for, except in certain sections, such as Texas, where a very severe drouth has made most producers take a rather pessimistic view.

It is evident, of course, in all the predictions for 1926, both as regards expected production and expected prices, that the fundamental optimism of nearly all American business men is revealed. General conditions, of course, at this time fully justify at least as good a demand in 1926 as in 1925.

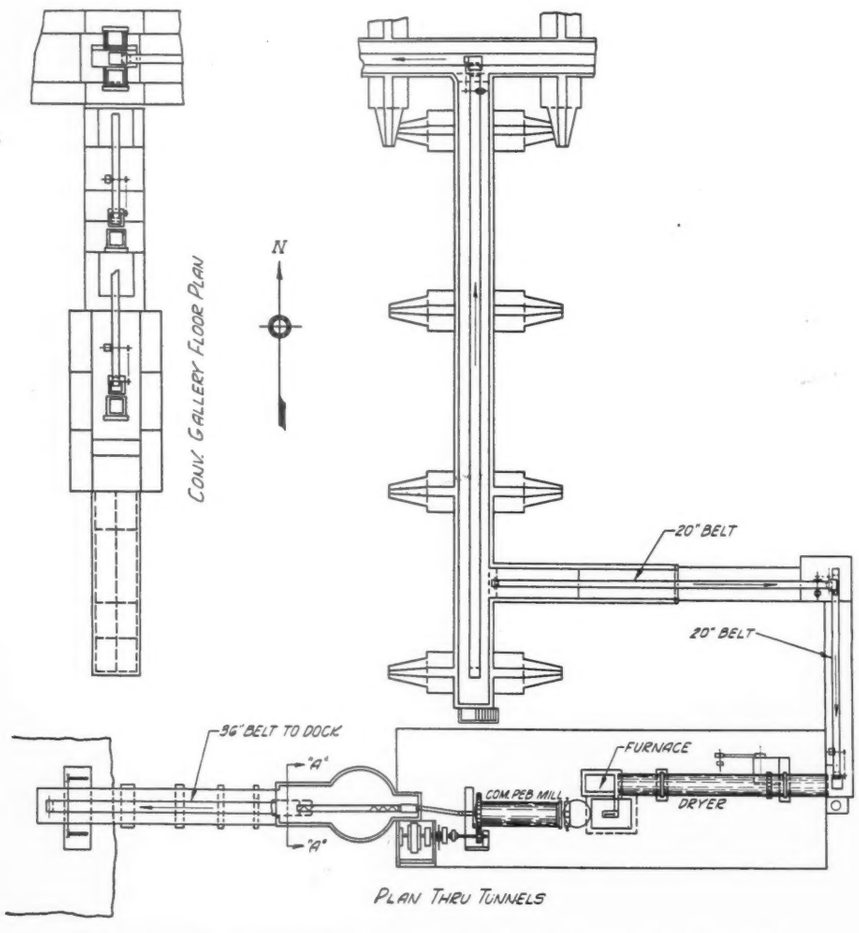
New Developments

A study of our incorporation notices of new concerns and capital increases in the quarry industry leads us to conclude that about $20,000,000 has been added to investments in this industry in 1925. About 80 new quarry companies were incorporated, not all of which, however, are active. Florida and the Southeast, of course, show the greatest activity in new concerns and new plants. The demand here has been apparently very great and insatiable; but an accurate estimate is impossible because of railway embargoes and inability of producers to move their material.

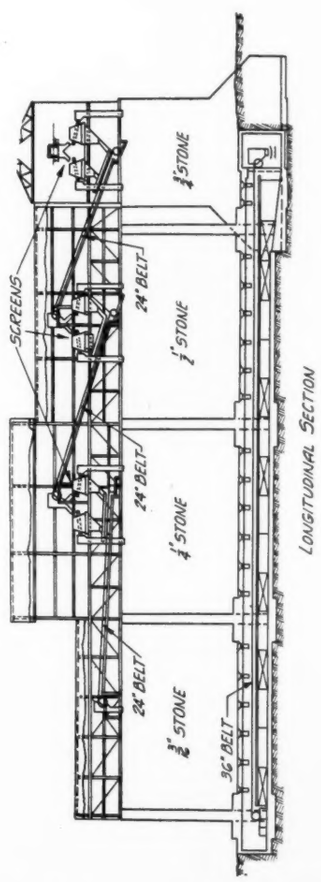
Outstanding financial developments in the quarry industry were the bond flotations of the Connecticut Quarries Co. ($350,000) and the Canada Crushed Stone Co., Ltd. ($300,000). These were, so far as known, the first attempts to sell crushed-stone securities to the general public, through reputable banking houses. No difficulty was experienced in either case, although the interest on this new capital, after deducting commissions, probably is 8% or more.

Another happening of importance to the future progress of the crushed stone industry was a meeting in February of a special section of the American Institute of Mining and Metallurgical Engineers devoted to a discussion of quarrying and the crushed stone industry. This was the first formal recognition of the quarry industry by professional mining engineers, and while not very well attended by mining engineers, nevertheless was a beginning.

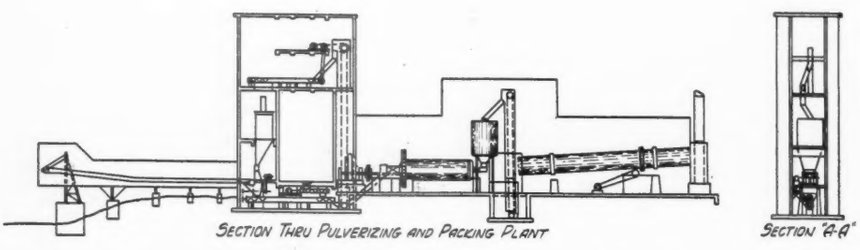
Another forward step in the industry was the formation of a quarry section of the National Safety Council. This marks the first national movement toward an organized attempt to reduce quarry accidents.



Plan of stone storage at the new Verplanck plant of the New York Trap Rock Corporation



Longitudinal section of stone storage



Longitudinal section through limestone pulverizing plant—Plans reproduced by courtesy of New York Trap Rock Corporation and the Burrell Engineering Co., designers and contractors

Technical Developments

In our review of the quarry industry in 1924 we recorded the loss by fire of three well-known crushing plants and the beginning of their rebuilding in structural steel and concrete. All three of these new plants have been described in detail in ROCK PRODUCTS during 1925—the Akron, N. Y., plant of the General Crushed Stone Co., May 16; the Verplanck, N. Y., plant of the

New York Trap Rock Co., June 13; and the Krause, Ill., plant of the Columbia Quarry Co., August 8.

The last two plants are the most interesting in point of novelty. The outstanding features of the New York Trap Rock Co. plant are the 48x60-in. initial jaw crusher set in a watertight pit in the quarry floor, the use of "Cataract" grizzlies and shaking screens for sizing. The only revolving screens used are four 60-in. by 20 ft., with 2⅞-in. perforations, which pass the commercial sizes. At the Krause plant of the Columbia Quarry Co. is what is claimed to be the first really successful rotary tipple for dumping quarry cars—previous installations being too slow in operation. This tipple dumps two cars at a time, without uncoupling them from the train (the cars have swivel couplers); it makes a full cycle in 30 sec., and has a capacity of 720 tons per hour. Another feature is the large size secondary crushing equipment—a No. 8 and a No. 10 gyratories. The No. 18 gyratory is set to pass 6-in. stone, and experience here had proved that the "neck of the bottle" was the secondary crusher capacity. All the fine sizing at this plant is done on special hexagonal screens and shaking screens.

The design of this plant was by the Allis-Chamlers Manufacturing Co.'s engineers, and the plans are reproduced here for the first time. It is referred to as a "remarkable plant in various respects." It is so laid out that the crusher may be fed from trains from two quarry levels simultaneously.

A new plant for the Florida Rock Products Co., near Tampa, Fla., is chiefly notable for having a very complete washing plant and picking belts to insure a clean, uniform product under unusual operating conditions. Other plants destroyed by fire in 1924 or early in 1925 and since replaced with modern structural steel and concrete structures are those of the Carbon Limestone Co. and the Lake Erie Limestone Co. at Hillsville, Pa.

Fire damage to plants in 1925, apparently was not so extensive as in the previous year. We recall but one severe loss—that of the Monroe, Mich., plant of the France Stone Co., which is now being rebuilt in structural steel and concrete.

Two typical new crushing plants in the Central West are those of the Blackwater Stone Co., Blackwater, Mo., and the Clay County Crushed Stone Co., Birmingham, Mo. This latter operation is chiefly notable as being one of the first mining operations ever started for the production of commercial crushed stone exclusively. Most stone mines have been developed after quarry operations.

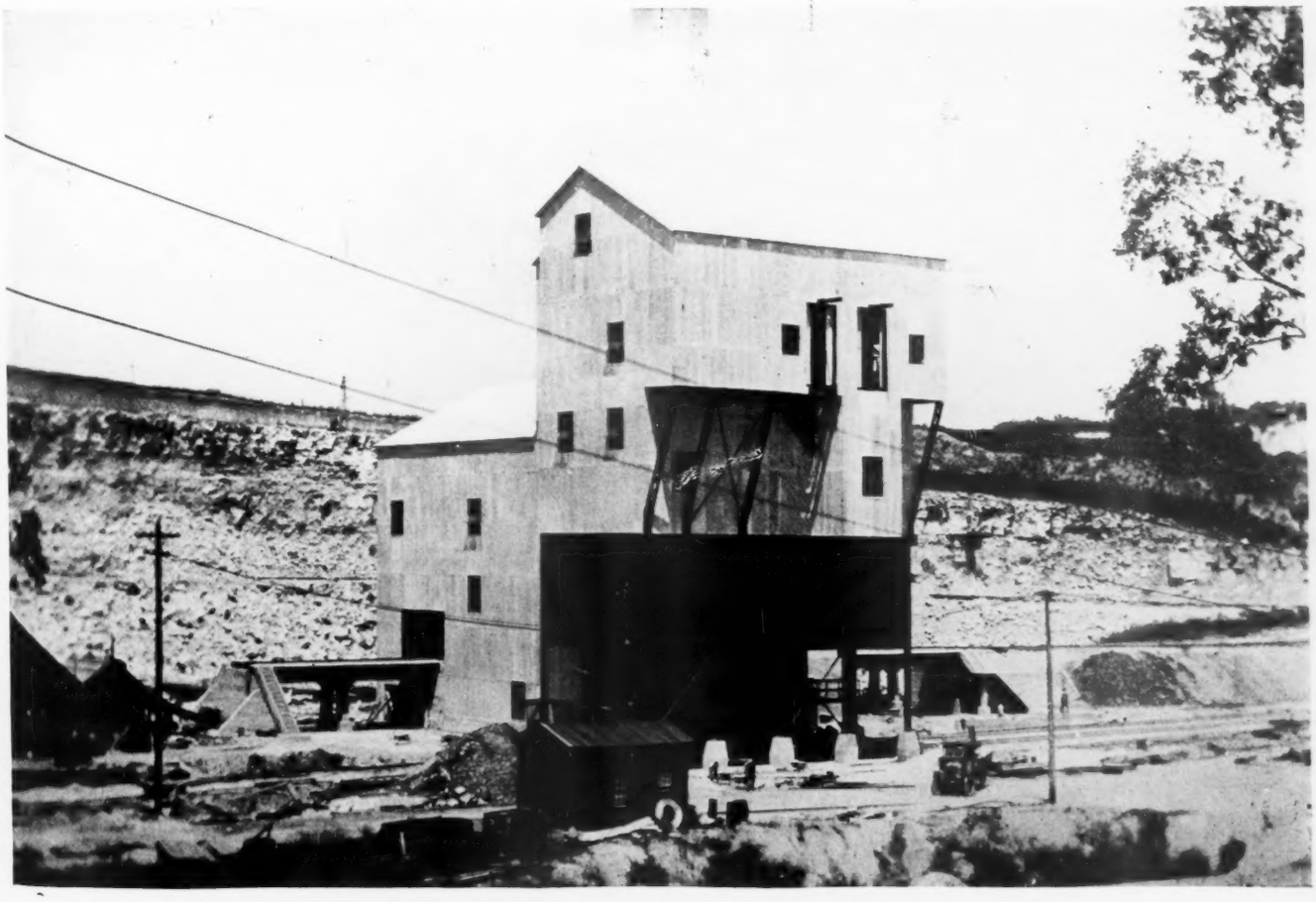
Mining of limestone is making considerable progress, especially in the vicinity of Kansas City, Mo., where nearly all of the more important quarry operations have been converted to mining operations. The Missouri Portland Cement Co. is building a new commercial crushed-stone plant there, to depend entirely on stone from underground workings.

Additions, changes and improvements at various plants were numerous. The Pittsburgh Limestone Co. quarries at Clover Creek, Blair county, Pa., were reopened after a two-year shut-down, having been electrified in the interim. This is a fluxing-stone operation and is evidence of the increased demand for furnace flux during 1925. The Southern Minerals Co., Winnfield, La., resumed operation of its 1500-ton-a-day limestone plant. Typical modern improvements to an old established crushing plant of modest capacity are those of the Belmont Gurnee Stone Co., North Berger, N. J., described in detail in our December 12 issue.

The most interesting crushed stone operation being developed now to be ready for operation in 1926 is the new trap-rock plant of the Tomkins Cove Stone Co. at Haverstraw, N. Y. This quarry will produce the first trap rock from the Hudson river Palisades in six years or more.

Pertinent Paragraphs on the Quarry Industry

The following quotations (anonymous here) from our friends in the industry give snap-shots of the state of the industry more



General view of the new Krause, Ill., plant of the Columbia Quarry Co.

graphically than we can summarize:

"Stone producers are a bunch of price-cutting fools."

* * *

"Too many people after the same dollar."

* * *

"With constantly increasing competition between existing plants producing various aggregates for highway construction and concrete, with the tendency to develop more roadside pits and quarries, it seems to us that every producer should 'cut corners' wherever possible to decrease operating and overhead costs. Prices in 1926 should, and probably will, remain about the same, but we shall be prepared to meet a slight decline if competition should necessitate."

* * *

"The slowing down in our industry in 1925 has brought about a co-operative spirit, that has a tendency to destroy selfishness; also it has caused prices to be reduced, where they have been a little high."

* * *

"Except for some national calamity prosperity has gained such headway as to easily carry over 1926."

* * *

"We look for a good year as there is nothing that will destroy the confidence of the industries, except it be some artificial manipulation."

* * *

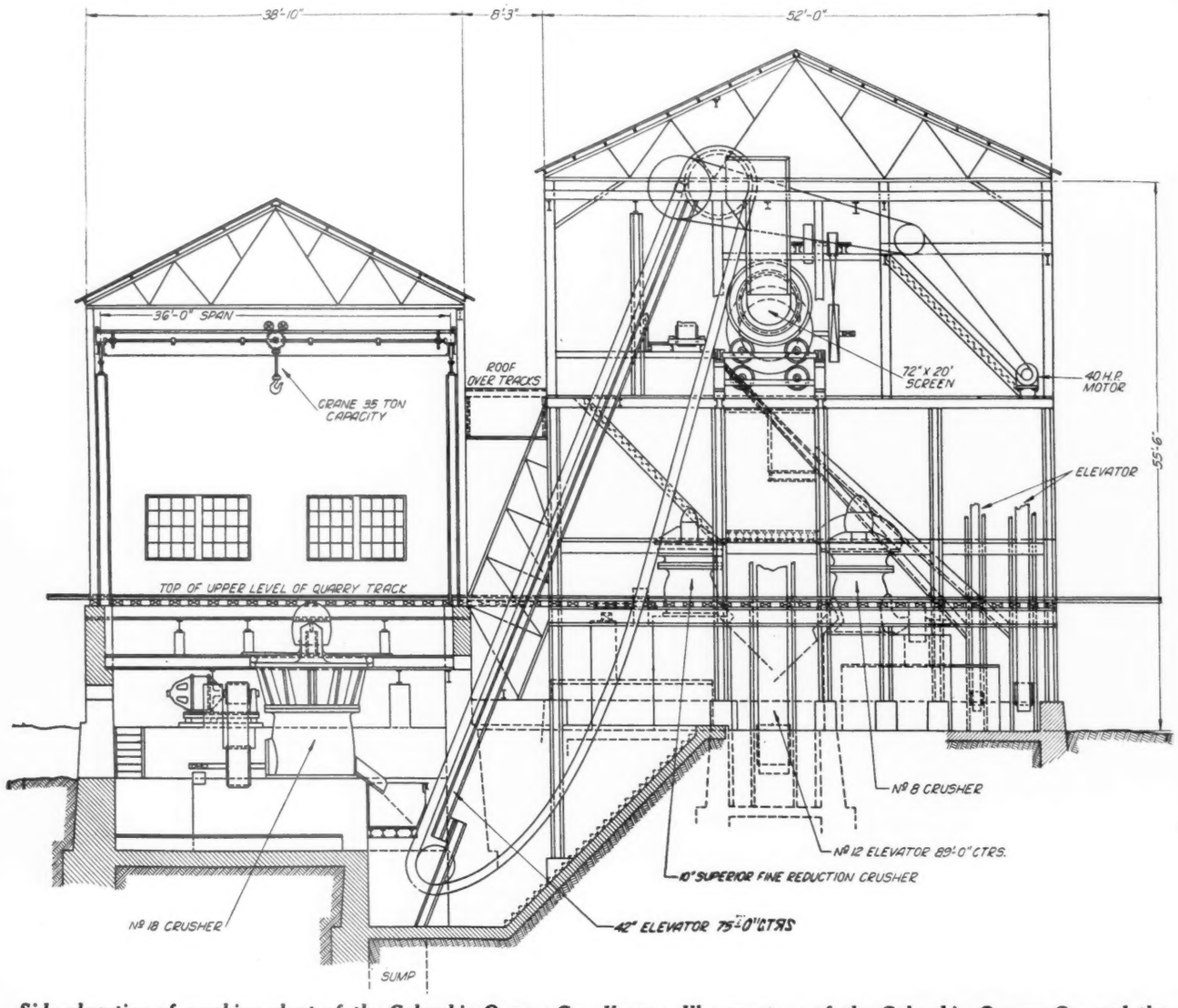
Slag Competition Worries Middle East

"In this section (Middle East) we meet some competition from slag producers, especially on county bridge work, where slag is permitted for all concrete work except the light slabs and railings. Generally, we do not think that slag is making any great headway against crushed stone; architects generally agreeing that stone is preferable. We are now (November 16) going into our seasonal slump so far as selling is concerned, but we shall continue to crush when weather permits and stock sizes which we should be able to move readily in the spring. Conditions seem favorable and we are optimistic."

"Our demand for the past few years has been practically the same each year (Central New York) and present indications are that 1926 will show about the same demand."

* * *

"Owing to the inroads made by slag in our section (eastern Ohio) competition was keener and prices lower. Unless freight rates on all road-building materials are equalized the crushed-stone operator is going to be forced out of business wherever slag competes."



Side elevation of crushing plant of the Columbia Quarry Co., Krause, Ill.; courtesy of the Columbia Quarry Co. and the Allis-Chalmers Manufacturing Co., designers and builders

Varied Conditions in East

"There has been a tremendous activity in road building in North Carolina during the past few years. This work is beginning to drop off and there are at present more quarries in our section than can operate profitably. For this reason 1926 will probably be a smaller and poorer quarry year than 1925. We believe, unless some quarries decide to curtail operations entirely, that the outlook in North Carolina is not bright for 1926. This is entirely a local condition as it would appear that the industry generally

will increase in 1926."

* * *

"We feel that the demand for crushed stone will continue in large volume for the next ten years, at least, and for the immediate future prices will remain about the same as in 1925 (Middle Atlantic States)."

* * *

"It so happens now, however, we experienced the same conditions one year ago, which lasted until April of this year. The improvement this year is apparently uncertain for any duration into 1926. Overproduction in all lines make a long continuance of the present improved conditions very uncertain."

* * *

"Our anticipated increase for 1926 is due partly to particular projects in our territory, and partly to increase in plant capacity. The tendency of prices has been downward in our territory for the past two years (Central New York)."

* * *

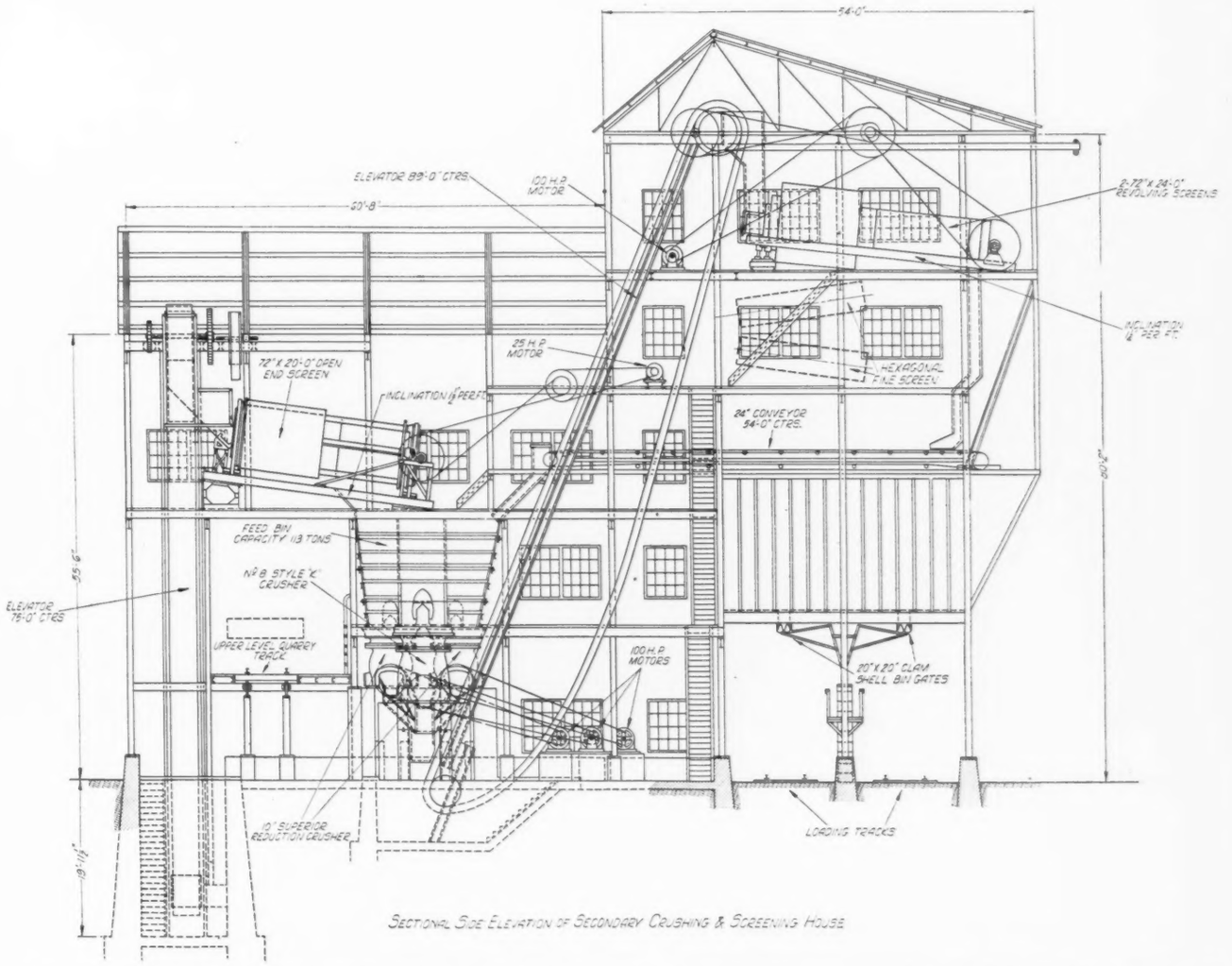
"Weather conditions and higher cost of operation were our troubles. Hope to see a change for the better in 1926."

* * *

"The stone industry is established on a firm basis. In this section (central Pennsylvania), however, a deplorable condition has existed because competing producers have cut prices, in some instances 40% below a fair price."

* * *

"The year 1925 has been one of our best, both in flux production and commercial stone. I look for a continuance in 1926."



Side elevation of the crushing plant of the Columbia Quarry Co., Krause, Ill.; courtesy of the Columbia Quarry Co. and the Allis-Chalmers Manufacturing Co., designers and builders

Florida and the South

"Indications for 1926 are that there will be more development in eastern Tennessee than in any previous year."

* * *

"Building and highway construction will reach its peak in 1926 in Florida, provided, of course, that the railroads can move the material. At present (November 17) all rock plants in Florida are shut down on account of a general embargo."

* * *

"Labor 50% higher than 1924, with additional increases expected (Florida)."

"Our increase in production does not reflect a proportionate increase in consumption, as our material is displacing imported products. Prosperity in construction industries encourages over-development in crushed stone and gravel, as is the tendency in Florida now. Present and contemplated producing capacity in Florida will exceed consumption by the end of 1926."

* * *

"We believe there will be a very large demand for crushed stone for at least ten years to come (North Carolina)."

* * *

"Looks as though 1926 will be a banner year (Central South)."

* * *

Central West

"We feel that there will be an overproduction in 1926, the same as 1925, of gravel and crushed stone within a 50-mile radius of Chicago. Prices are low due to strong competition and may go up or down, according to railway rate changes now before the Interstate Commerce Commission."

"Road-building outlook is better at this time (November 30) than last year, because of the amount of work uncompleted (Ohio)."

* * *

"Year 1925 was a good average year, in which operating costs were well under control and railway service very good (Ohio)."

* * *

"We contemplate increasing our capacity and will therefore have to look for additional business. (The cart before the horse in Ohio.)"

* * *

"The year 1926 will be at least 50% better in this locality (Ohio)."

* * *

"The year 1926 has been a vacillating one with many high and low periods. Competitive conditions due to over-production are responsible for prevailing ruinous prices. Stabilization can only come when demand catches up with production (Ohio)."

* * *

"Two large plants in western Missouri and one large plant in the central part of the state, plus the new large plant now building near Kansas City (which will be producing next spring) will have a tendency to lower prices and eliminate the smaller producers, who are not equipped to produce quality material and in large volume."

* * *

"Bad weather for construction has kept a great deal of work over for 1926 (Missouri)."

* * *

"Highway construction in our locality (eastern Wisconsin) will increase over 1925 about 25%. Building construction will remain about the same, but as a whole we expect better business in 1926. The year 1925 was very slow in this locality."

"The greatest difficulty confronting our limestone plants in this locality (Kentucky) are freight rates that seem too high to place us on a parity with competitive products. We believe this is generally true throughout the crushed-stone industry."

* * *

"I believe, generally, the construction of highways has not reached its peak as yet. Automobile and truck traffic are wearing out the roads we have faster than we are rebuilding and repairing them (Indiana)."

* * *

"This year turned out better than we expected, the way conditions looked in the spring (Wisconsin)."

* * *

"The highways are nearly all built around here (Wisconsin)."

* * *

Increasing Prospects in Corn-Belt

"Minnesota has a big paving program for 1926, and the outlook is that all Minnesota quarries will be kept exceedingly busy during the coming year."

* * *

"Gasoline tax will make more money available for highway construction in Nebraska."

* * *

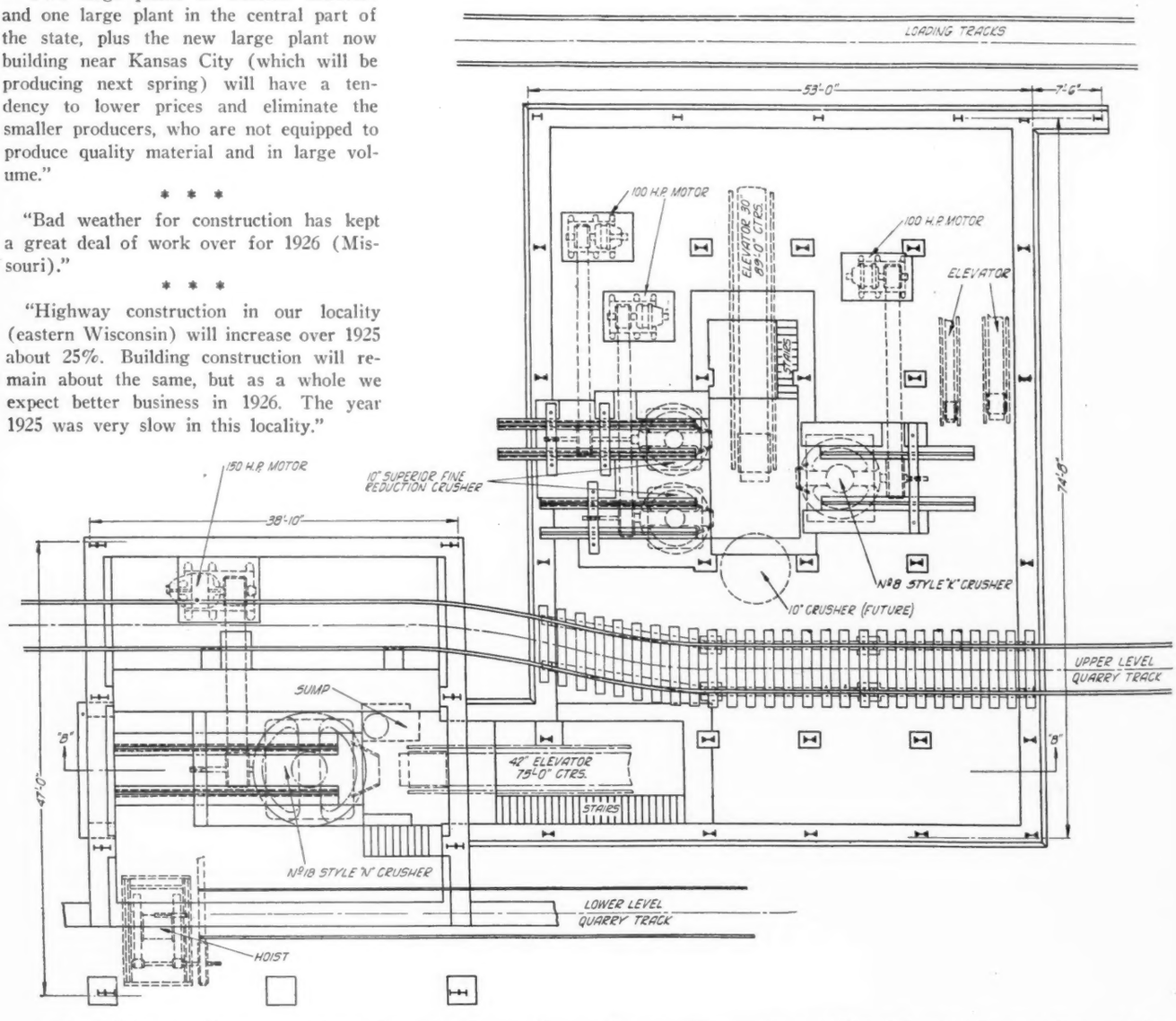
"The crushed-stone business is in the dumps on account of the great quantities of sand and gravel in this section (Nebraska)."

* * *

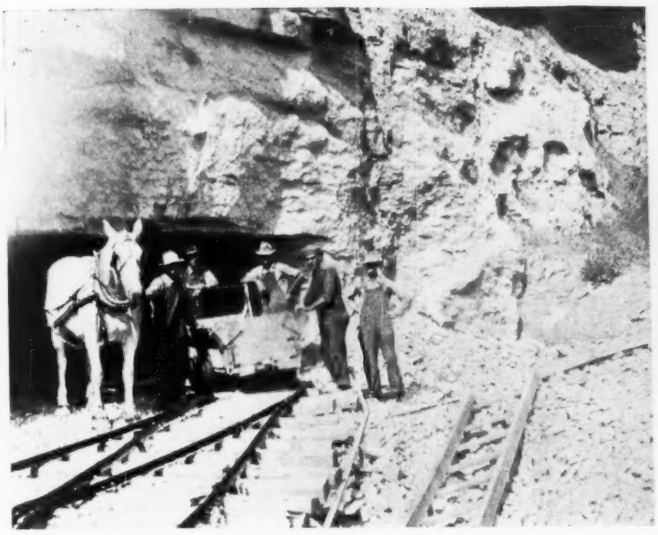
"We are selling all the screenings that we make to farmers. Other operators report heavy sales. If the farmers have the success early experiments indicate as a result of using limestone, we should get a hard-roads legislature in 1926 (Iowa)."

* * *

"Construction work will show a decided increase during 1926. Bids on municipal paving will be called for early in the year, and this will allow contractors to get an early start. It will eliminate the sluggish condi-



Plan of the crushing plant of the Columbia Quarry Co. at Krause, Ill.; courtesy of the Columbia Quarry Co. and the Allis-Chalmers Manufacturing Co., designers and builders



Mining limestone at Clay County Crushed Stone Co., Missouri

Crushing plant of the Clay County Crushed Stone Co., Missouri

tions that prevailed here during the first half of 1925 (Iowa)."

* * *

Texas and Southwest

"Don't look for very much of a change—if any it will be for the better (Oklahoma)."

* * *

"Conditions confronting us for 1926 are better than at the same time of year in 1924—more crushed-stone business in sight at better prices (eastern Texas)."

* * *

"Next year will be a political year in Texas, and this is too early to predict."

* * *

"New highway construction, maintenance of existing roads, general building construction, ballasting of railroads all offer a fair market for crushed stone during the coming year (Texas)."

* * *

"Railway rates on crushed stone and gravel are so high that a great many small gravel plants are springing up near the cities and delivering on the jobs with motor trucks (Texas). This condition will have to be remedied if established plants on railways are to survive."

* * *

Northwest

"The additional highway work contracted for 1926 in our territory (Northwest) has made prospects brighter for the temporary producer, and consequently worse for the industry with a permanent investment."

* * *

West Coast

"The industry is now in a period of strong destructive competition, but time will mend the trouble (Oregon)."

* * *

"About our only prospect for a large increase in output is ballast for the railways, which we are gradually being equipped to handle each year as our quarry is developed (Oregon)."

* * *

"On account of a heavy wet season early (central California), we got off to a very slow start. There was less summer slack season than in 1924, and a very much heavier fall rush, which is still continuing (December 7) with favorable weather."

Plant of the new Blackwater Stone Co.

Quarry of the new Blackwater Stone Co., in Missouri

Decomposed Granite Association Formed at Los Angeles

SEVERAL local dealers and producers have formed an association which is to be known as the Decomposed Granite Association, for the purpose of placing the uses and advantages of decomposed granite as a construction product before the building public.

The new association is composed of the Los Angeles Decomposed Granite Co., Miller and Burke, Bonfield Co., Bryson and Stahl, and the Hollywood Disintegrated Granite Co.

At a recent meeting of the association the following officers were elected: H. Y. Stebbins, of the Hollywood Granite Co., president; W. C. Burke, vice-president; W. A. Miller, treasurer, and W. S. Daum, secretary.

Decomposed granite is now being used for roads, subdivision streets, aviation fields, driveways, tennis courts, parking stations, industrial plants, and sub-base for sidewalks.

The Progress of Sand and Gravel in 1925

Increased Production, Better Plants and Great Technical Advances Make This a Notable Year

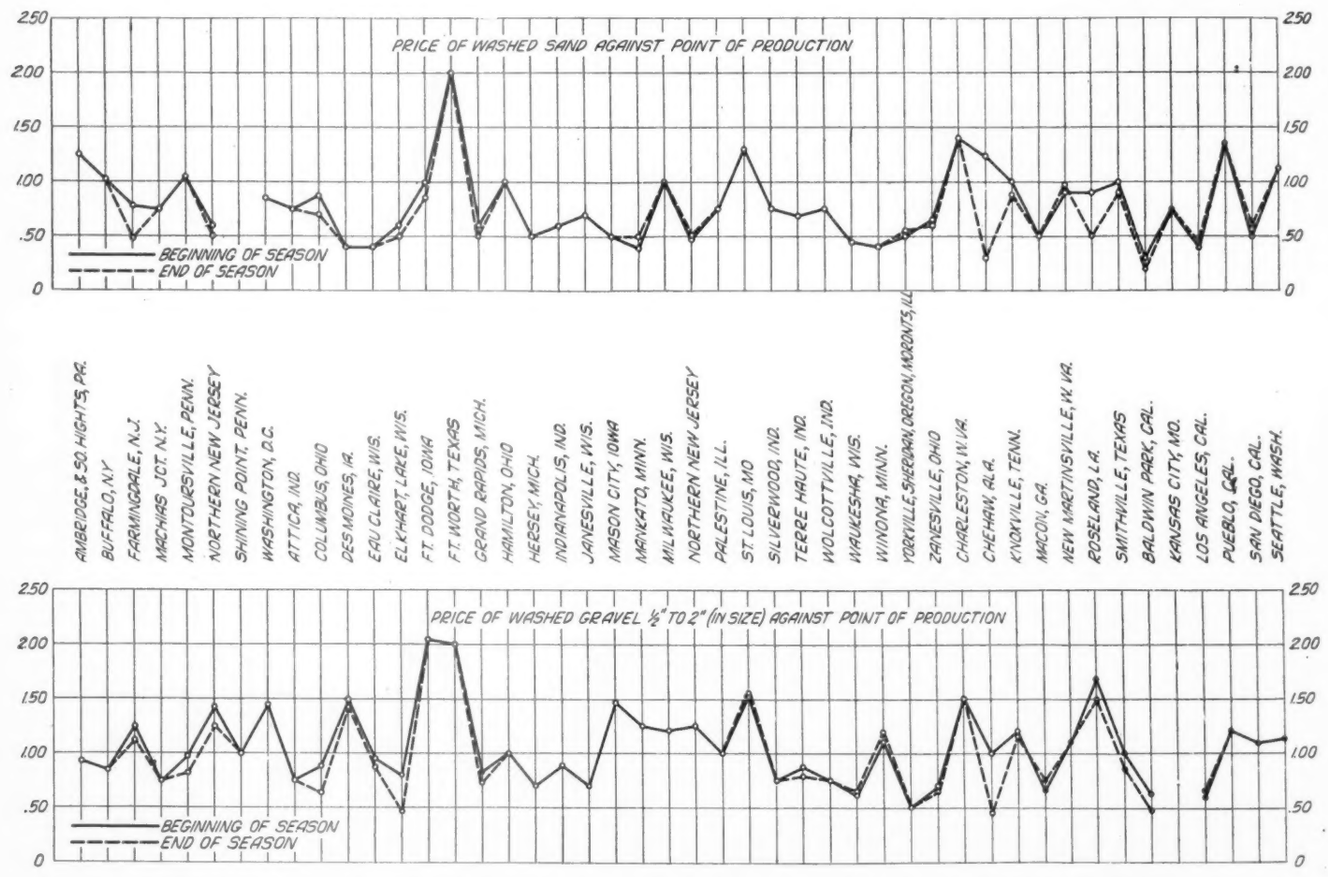
ROCK PRODUCTS' estimate of the sand and gravel production of 1925 is 170,000,000 tons. This is 8¾% increase over the production of 1924, which was approximately 156,000,000. The estimate for 1925 is based upon a consideration of several matters such as the reports of general construction throughout the country, the car loadings of sand, gravel and crushed stone and the shipments of portland cement. Above all there are the confidential reports made by producers in response to editorial requests, from which it is judged that a fair cross-sectional view of the industry may be obtained.

whole. The increase was pretty well distributed over the entire country, and wherever decreases were reported a local reason for such decrease was given, which shows that the industry as whole has had a satisfactory year.

Prices, however, have been lower. About 30% of the producers reported decreased prices as against 11% reporting increases. Taking these facts into consideration with a study of the market reports given in ROCK PRODUCTS it is judged that the prices throughout the country as a whole will show a decrease of about 1¾%.

There is no doubt, however, but that tion is lowered. And the reports of the industry in 1925 would seem to bear this out.

As to the future, the reports received from producers show that 67% of them expect an increased business in the coming year. Their expectations vary from nothing to 50%. Four per cent of the producers say that they expect a decrease in business. From such estimates a certain amount has always to be subtracted for the optimism of a man who is interested in seeing his business grow. Without this optimism and faith in an increased demand for his product he would not be a



The price of washed sand and gravel at the important producing centers of the United States

Of the producers reporting, 66% reported increases, 17% decreases and 17% an unchanged production. The increases ranged from 1% to 110%, and the average was 16.5%. The decreases ranged from 50% to 2% and the average was 4.5%. As these are not weighted averages, the difference between these does not indicate the increase for the industry as a

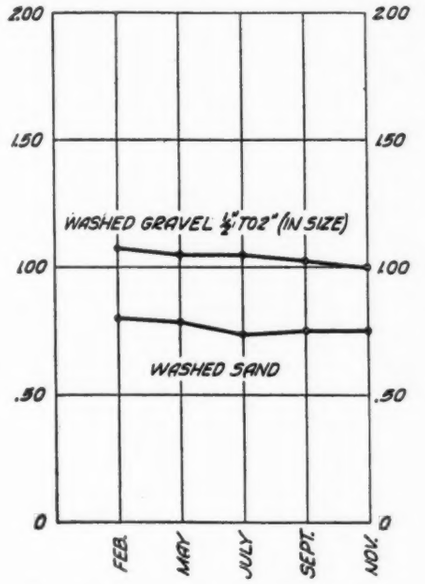
the industry has had a profitable year, for decrease in price has been more than met by lowered costs and increased output. Prices, as ROCK PRODUCTS has pointed out editorially, do not reflect the demand for sand and gravel. It would be fairer to say sand and gravel prices reflect the cost of production, the consumer sharing in the saving whenever the cost of produc-

success. But after subtracting this it may be said that the sober judgment of the majority of the producers is that 1926 will show a much increased production over 1925.

In analyzing their reasons for this belief, it was noted that practically all those who expected increases looked for more highway construction and for more pub-

lic works construction. As these are matters about which producers generally keep themselves fairly well informed, their judgment is probably correct. As regards others forms of construction, residences, office buildings and the like, a little more than one-half of the producers reporting judged that the peak of such construction had passed in the localities with which they were familiar.

An important feature of the year's progress has been the flotation of bond issues by some of the larger companies. It is significant that these were absorbed by the public in the same way that any industrial securities are taken up, which shows that the public now classes sand and gravel with the important industries of the country.



Course of washed material prices throughout the season

The total of such bond issues as have been reported was $3,250,000, and the companies issuing them, and the amount of each issue, are as follows:

Wisconsin Lime and Cement Co., Chicago, $750,000; Lyman-Richey Sand and Gravel Co., Omaha, $500,000; Construction Materials Co., Chicago, $650,000; Superior Sand and Gravel Co., Duluth, $650,000; Rhodes-Jamieson Co., San Francisco, $500,000; Lincoln Sand and Gravel Co., Lincoln, Ill., $100,000.

There were 235 new sand and gravel incorporations recorded, the total amount of capital stock being $19,000,000. This includes reorganizations, new stock issues and incorporations which have so far done nothing more than the filing of incorporation papers so that it cannot be said that this all represents the new capital added to the business.

Where the Production Goes

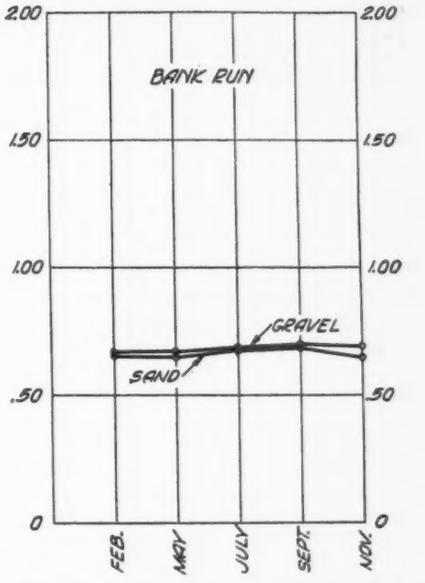
Producers were asked this year to state into what branches of construction the sand and gravel went, and the answers were interesting. The largest number of those who answered the questions, 47½%, said that the product was portioned about equally between highway work, public work and general construction. Those who said that the product went principally to highways were 24%; 18% said that general construction absorbed the greater part of their product, and 8% gave first place to public works. Some of these were careful to mention that city paving was included in public works. A small number of producers, 2½% of the whole, said that their product went principally to railroad ballast.

New Sand and Gravel Plants

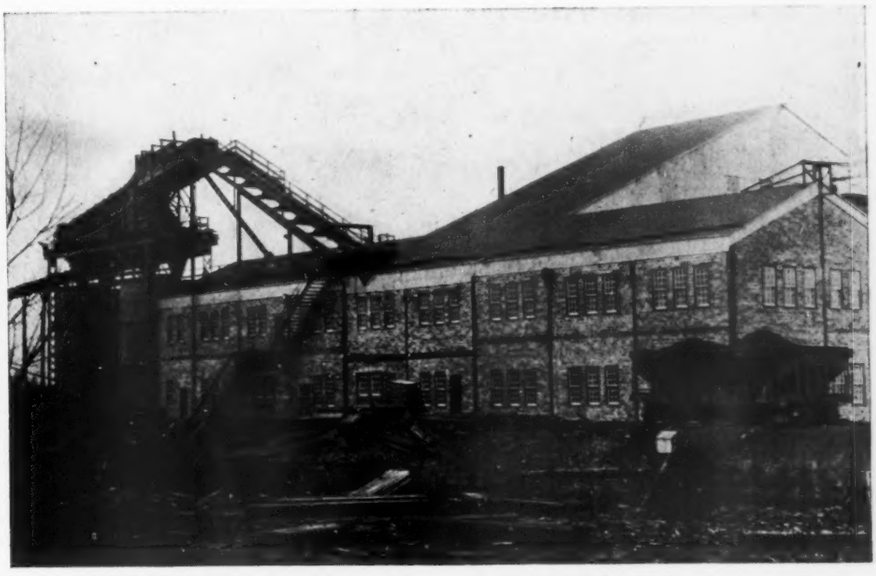
A number of new plants have been built during the year just closed and a great many more have been added to and brought up to date. Readers of Rock Products have been kept fairly well informed as to these. In running over a list of those of which descriptions have been published the first thing noted was that without exception they were built by companies who were already engaged in sand and gravel production. Of course new plants have been built by those who have just entered the field but the production of these accounts for only a small fraction of the increase.

It would be outside the purposes of this article to review each plant especially since descriptions have already been published. But there are certain plants which may be taken as examples to show the trend of the industry. As an illustration the Manor plant of the Charles Warner Co. of Wilmington, Del., should be mentioned to show the tendency toward better and more permanent construction than has been usually found in sand and gravel plants. The machinery in the Manor plant is housed in a splendid structure of steel and hollow tile and the best construction has been used throughout. The plant is intended to run night and day for the life of the deposit and there is every reason to suppose that it will do so.

Conveyors for bringing material from the pit to the plant seem to be growing in favor somewhat and some excellent examples have been built. The Cleves plant of the Ohio Gravel Ballast Co., near Cincinnati, Ohio, is perhaps the most important development of this system. One conveyor in the system is 658 ft. long and goes through a tunnel under a concrete highway, over railroad and trolley tracks and finally rises to the top of the washing and screening plant some 80 ft. above the ground. It is one of the most notable conveyor installations to be installed anywhere. The Massillon Sand and Gravel Co., Massillon, Ohio, is another plant which has an excellent instal-



Course of bank run prices throughout the season



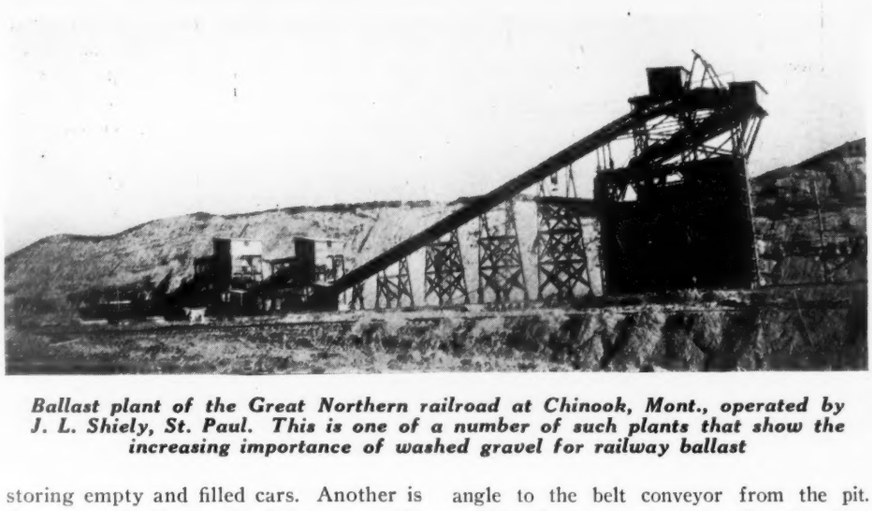
Manor plant of the Charles Warner Co., notable for its housing to permit day and night work in the winter as well as in summer

Plant of the Reliance Rock Co., Los Angeles, perhaps the largest plant put up on Pacific Coast in 1925

lation of a field belt and it carries the idea somewhat farther than is usual because it uses a portable section in the pit.

But the most spectacular use of conveyors is probably that of the Port Crescent (Mich.) Sand and Fuel Co. of Detroit (June 7 issue). There is practically nothing to this operation but digging and transportation, for a locomotive crane digs the sand from the dunes on the shore of Lake Michigan and the belt takes it from the crane to the company's docks where it is loaded on a ship. Nearly two miles of belt are used in this installation.

Of plants which have not yet been described in detail but which are among the noteworthy installations of 1925 mention should be made of the new plant of H. D. Conkey and Co. at Mendota, Ill. This is a Link-Belt plant and the designer of this company, C. S. Huntington, has employed the right angle layout which he has brought into general use in the last two or three years. There are several advantages to this right-angle layout over the old straight-line. One is that it permits a better arrangement of tracks for storing empty and filled cars. Another is that where trucks are loaded on one side of the bins there is more room to arrange for trucks to drive in and out. The material goes straight from the pit to the track and since the bins must load into cars the logical arrangement is to set the bins parallel with the track and at a right angle to the belt conveyor from the pit.

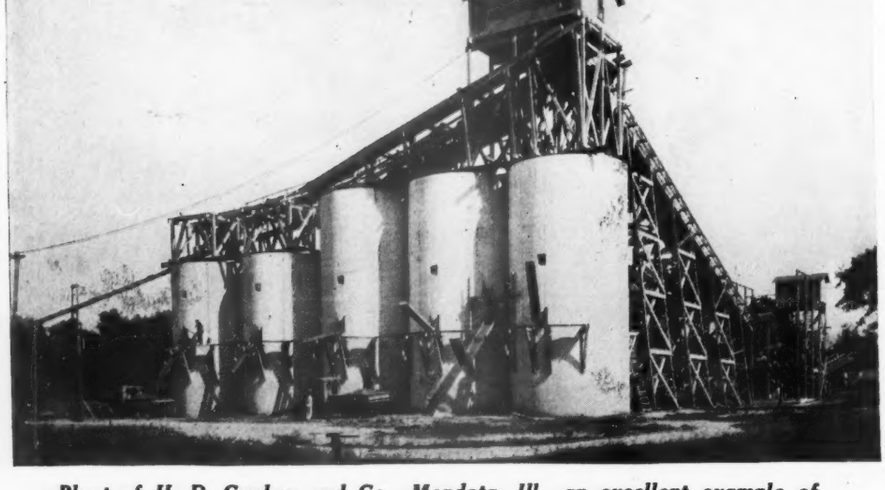


Ballast plant of the Great Northern railroad at Chinook, Mont., operated by J. L. Shiely, St. Paul. This is one of a number of such plants that show the increasing importance of washed gravel for railway ballast

This plant uses concrete silos for bins which are now in strong favor with the builders of plants. There is a good sized primary crushing plant since the ground contains a fair proportion of boulders. These are crushed by a No. 4 Allis-Chalmers crusher. The remainder of the equipment is all of Link-Belt construction.

A feature not entirely of this year but one which has developed during 1925 is that of plants put up especially to produce washed gravel. One of these is illustrated on this page, erected by the Great Northern railroad at Chinook, Mont., and operated by J. L. Shiely of St. Paul. This is only one of three plants put up on the Great Northern lines. Other railroads have put up plants of this kind. The railroad engineers and the sand and gravel producers are getting together on the matter of ballast so that the producers know what is needed and the engineers understand the possibilities of local material.

A plant which is perhaps the largest put up on the Pacific coast in 1925 embodies the established practice in southern California. It is rather more of a rock crusher than a sand and gravel plant as so large a part of the bank run is made up of boulders which have to be crushed. It was erected by the Reliance Rock Co. of Los Angeles.



Plant of H. D. Conkey and Co., Mendota, Ill., an excellent example of right-angle design

General Problems of the Industry

The Sand Problem

In 1925 it may be said that some progress has been made with the excess sand problem, although some of the work has been experimental rather than on a practical scale. The deposits in many parts of the United States contain so much more sand than gravel that sand has to be wasted when it is dug and washed with the gravel. Of course there are districts, as in central New York state and around Pittsburgh, Penn., and Nashville, Tenn., where sand is really short and substitutes such as crushed gravel are coming into use. But in many plants on the Atlantic coast and in the central states east of the Mississippi there are to be seen great piles of stored sand waiting for a market. In some of the central states there is an excess of fine pebbles, ⅜-in. to ⅝-in., also to be disposed of.

The success of the Lyman-Richey Sand and Gravel Co. of Omaha (first published in Rock Products, September 19, and more fully in the December 12 issue) in making a satisfactory aggregate for mass concrete of material all finer than ¾-in., has started experimenting in several parts of the country, notably in Wisconsin and Indiana, and in localities where good coarse aggregate is short it is probable that a demand for the sand-gravel mix may develop. Increased use of concrete products is offering another market.

The National Sand and Gravel Association formed a concrete products section at its last annual meeting and convention and a great deal of interest was shown in the first meeting. In the coming convention it is expected that this will be increased. Where sand and fine pebbles are both in excess, concrete products would seem to offer the ideal market. In some localities producers have gone into the concrete products business and in others they have encouraged the products makers to use their aggregates by leasing them a plant site and furnishing the aggregate to them on a favorable contract. An example of the latter method is given in the article on the Granite Sand and Gravel Co.'s plant at Indianapolis, Ind., published in Rock Products, April 18.

Special Sands

The making of special sands such as filter sands and blast sands offers another field for disposing of excess sand. It must be said, however, that all sands are not adapted to making these products, such qualities as hardness, roundness of grain, and freedom from limestone, shale and some other substances being essential. The market for these sands is somewhat limited and their manufacture requires a rather expensive plant including dryers and fine screening systems, since such sands have to meet very closely drawn specifications when they are sold.

Excess Gravel

The problem of what to do with excess gravel is confined to a few localities, but in these localities it is pressing. No new plants for crushing gravel to sand have been reported, but from reports received it is evident that such plants are contemplated. The Keystone Sand and Supply Co. of Pittsburgh, Penn., which has gone farthest in developing this business has its plant producing steadily and finds a ready market for its product, according to report.

Demand for Specifications

Several producers have expressed themselves as favoring specifications for sand and gravel, or for concrete aggregate in general, which would have a national application, the idea being to keep unfit material from the general building market as far as possible, in the same way that the specifications of different highway departments regulate the material that can be used in concrete highways.

National Research

One of the most important advances in the industry was made when the National Sand and Gravel Association instituted an engineering and research division. This was placed under Stanton Walker a month or two ago. Concerning this department and the work which it will do, T. R. Barrows, executive secretary of the National Sand and Gravel Association, has written the following for this review:

"It is provided in the constitution of the National Sand and Gravel Association that the organization shall engage in promoting and extending the use of the high-grade products of its member companies.

"In carrying out this mandate of the constitution, the Association, during 1925, has maintained close relationships with professional and technical societies whose work involves in any way the use of sand and gravel and has represented the industry before those departments of the government which are charged with the preparation of specifications to insure the satisfactory construction of highways and structures.

"With a recognition that this activity has produced such beneficial results for the established sand and gravel industry all over the country, the executive committee of the National Sand and Gravel Association determined to enlarge its scope in order that its advantages might be more fully realized. The first step in this program was the creation of the engineering and research division of the association, at the head of which is Stanton Walker, for many years connected with the Structural Materials Research Laboratory of the Lewis Institute at Chicago and who is a recognized authority in the making and placing of concrete.

"This means a broadening of the engineering service which the association performs for its members, and Mr. Walker and his assistants will interest themselves in the development of facts concerning the production and marketing of the sand and gravel produced by member companies. This department will also identify itself with such organizations as the American Society for Testing Materials and other institutions connected with the construction industry, and it will devote close attention to the work of the U. S. Bureau of Public Roads, the U. S. Bureau of Standards, as well as cooperating with the various state highway associations and organizations of county and municipal engineers.

"The purpose of the engineering and research division of the National Sand and Gravel Association, briefly expressed, is to place in the hands of all interested parties full information with respect to the economical value of properly prepared sand and gravel. In doing this, it will point out the advantages of using a good material as compared with the disadvantages of using a poor material. In short, it will emphasize quality sand and gravel and such emphasis will consist of data provided by actual tests of material produced by our member companies.

"Our engineering and research work was started some months ago and it has consisted of the preparation of articles, supported by the proper authorities, dealing with the correct use of sand and gravel. It has, in addition, furnished to members information with reference to testing of their materials for the determination of certain properties.

"The National Sand and Gravel Association represented the sand and gravel industry this year in the work of the Federal Specifications Board, this latter body having been charged with the duty of preparing specifications for use by all branches of the government in the purchasing of commodities which it employs in federal-aid road work and in all general construction work of the government.

"The specifications relating to the use of sand and gravel were submitted to the National Sand and Gravel Association for criticism and suggestion before they were adopted by the board and, in this way, the association was enabled to insure that the provisions of the specifications were such that they would call for the use of properly prepared sand and gravel."

"It is appropriate for me at this time to refer to the most outstanding achievement of this year in the established sand and gravel industry; and that is the results of the work of the Washed Gravel Ballast

Committee of the National Association, the chairman of which is Mr. Earl Zimmerman of Cincinnati. I am able to say with perfect assurance that the accomplishments of this committee have opened a greater outlet for the materials produced by our member companies, accompanied by a more fitting recognition on the part of railroad engineers as to the suitability and economy of washed gravel ballast.

Improvements in Digging Bank Material

Improvements in excavating machinery and methods, other than dredging, have been in the way of improving on existing machines and employing larger and heavier machines for increasing production. Improvements in machinery are covered in the new machinery section, but there are some things peculiar to the sand and gravel industry which seem to be in place here.

One of these is a system by which the plant of the Reliance Rock Co. is kept steadily at the production rate of 600 tons per hour. The bank run material is drawn to the plant in a car which runs on an incline and the limit to production is the number of trips that can be made. Using conservative rope speeds on the hoist that pulls the car it was found that a round trip could be made in two minutes—30 trips per hour. This called for a 50-ton car, unusually large to use on an incline in either a sand pit or a quarry. A two-speed hoist was designed with a fast speed on the level track and a slower speed on the steep incline, which gave the hoist a considerable mechanical advantage.

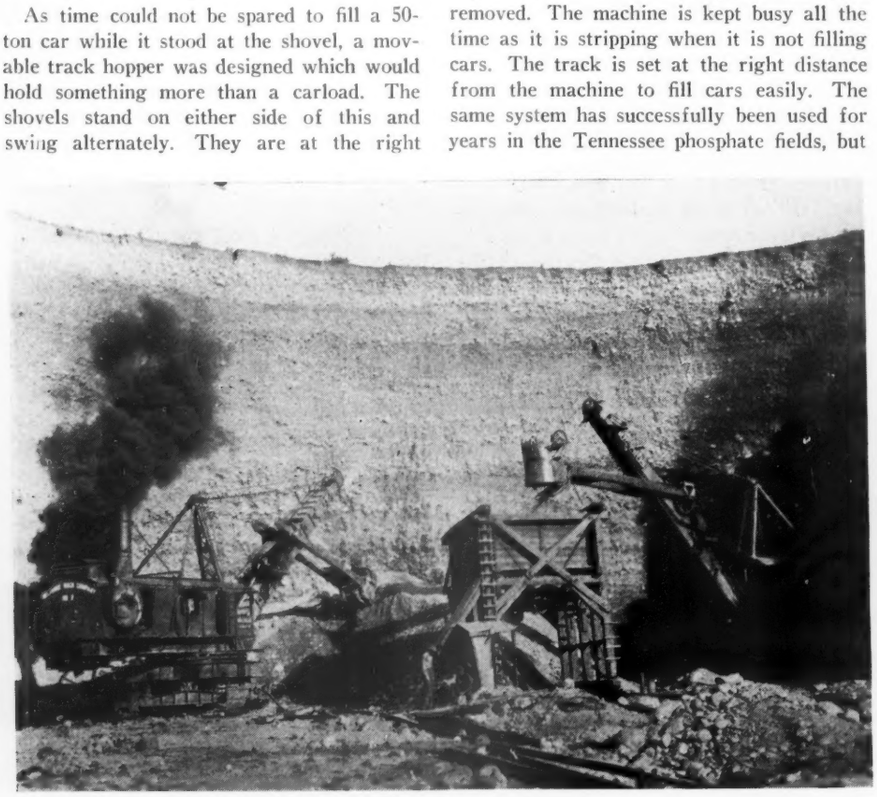
As time could not be spared to fill a 50-ton car while it stood at the shovel, a movable track hopper was designed which would hold something more than a carload. The shovels stand on either side of this and swing alternately. They are at the right distance from the hopper so that no time is lost "racking in" before discharging the dipper. The whole arrangement works with clocklike regularity, as if it were a complete machine in itself. It was worked out by A. O. Hadsel, operating manager of the company.

Another interesting solution of a sand and gravel problem was noted at the plant of the Dallas Washed and Screened Gravel Co., near Arlington, Texas. This company has been producing some time but has only adopted the system described here this present season. The deposit is flat and 9 ft. of overburden has to be removed to secure 12 ft. of sand and gravel. Such an operation would not be possible without careful planning and systematic working.

A dragline (Diesel powered) does all the work of stripping and digging the gravel. A long cut is made and the stripping sidecast. When the end of the deposit is reached the dragline turns and makes another cut which widens the first cut. The strippings are sidecast into the first cut from which the sand and gravel has been removed. The machine is kept busy all the time as it is stripping when it is not filling cars. The track is set at the right distance from the machine to fill cars easily. The same system has successfully been used for years in the Tennessee phosphate fields, but this is the first time that it has been noted in recovering sand and gravel.

The main improvement in cableway dragline is to make them larger and heavier so that their capacity may be increased. In the Eastern states the largest size that has been regularly made by the leading manufacturers of these machines held 2½ yd. This year a 3½-yd. bucket was built and installed at a plant belonging to one of the largest producers on the Atlantic Coast. It is reported to be successful in every way.

New cableway dragline bucket which has 3½-yd. capacity



A carefully worked out method of supplying 600 tons per hour from the bank to the washing plant

A 4-yd. dragline installation near San Francisco, Calif.

Naturally all the equipment, including the hoist, had to be built on a scale to correspond.

Of course dragline buckets have been

By systematic working it is possible for 9 ft. of stripping to be removed to uncover 12 ft. of sand and gravel

made of the same capacity for handling coal from storage and these could be used with the 2½-yd. hoist and equipment since coal is so much lighter. But the advent of these large sized cableway draglines in the sand and gravel business is new so far as the Eastern states are concerned.

On the Pacific Coast cableway draglines of large capacity were tried out some time ago. Some forms and sizes were abandoned but others are giving excellent service. One which was installed a little over a year ago at the Elliot plant of the Coast Rock and Gravel Co., San Francisco, Calif., is shown here. It has a 4-yd. bucket and its operation is in every way a success.

Removal of Trash, Lignite and Shale

IN the next issue of Rock Products will be found a survey of the sand and gravel resources of the country in which is noted the fact that as the deposits of better material are exhausted producers will turn to those deposits which contain material requiring special preparation to bring it to the standards now required for concrete aggregate and similar purposes. The working of such deposits has already begun, and each year sees such work increasing. In Rock Products Annual Review and Directory Number for 1925 a single plant employing a special washing method was described—the plant of the Central Sand and Gravel Co. of Memphis, which uses jigs to remove lignite from gravel. This year other plants have been carrying on experiments in similar work and some of them have led to considerable success.

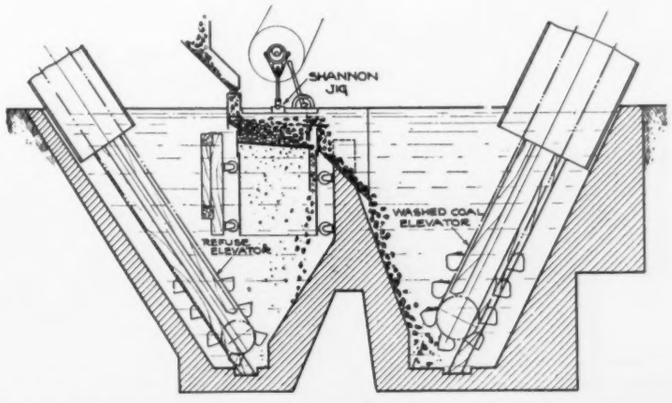
The firm of T. L. Herbert and Sons of Nashville, Tenn., has been working on this problem more than a year. The Cumberland river near Nashville has been dredged for a long time in a somewhat unsystematic way, and in many cases the sand was dredged out and the gravel thrown back in the river. This left a lot of holes in the river bed which collected sticks and trash and mud balls. In order to dredge the river bed systematically the Herberts experimented to find a method of washing out the dirt and debris. They first experimented with a washing cylinder but later gave this up in favor of a log washer. To this they applied several new features which made a new machine of it and it has been so successful that it is now being manufactured and sold.

The additions to the ordinary log washer are a skimming device aside from the overflow, and the use of hydraulic water, both of which are new in the industry. The skimming device is especially good as it lifts out pieces which would otherwise stick at the overflow. The use of hydraulic (rising current) water is important to lift out the lighter particles from the gravel and also to give a rinse to the gravel by freeing it from the muddy water. It is said that the machine will take out lignite as well as sticks and mudballs. It is described in the new machinery pages of this issue.

The Stewart Sand Co. has had a plant for removing lignite from sand for nearly three years. This year the classifier used for this purpose was redesigned and it is now working very satisfactorily. As a description of the method used in this plant has not been published before, it may properly be introduced in this review for it is considered now that the experimental period is over.

The work of this machine depends upon the principle that lignite which will sink in clear water will float on a mixture of sand grains and water kept in agitation. The specific gravity of the lignite is from 1.23 to 1.40 and the specific gravity of a mixture of sand and water in agitation may be easily kept near 1.60 which means that the mixture contains about 60% of sand. The difference in specific gravity is sufficient to keep the lignite floating.

The important point in designing the machine was to provide a way to keep the mixture of sand and water at a constant density. This was done by balancing a column of clear water against the column of sand and water. A float on the column of clear water regulates the discharge valve below the column of sand and water. When more sand is fed into this column the column becomes heavier and this causes the clear water column to rise which lifts the float and opens the valve so that the sand runs out faster. Actually the specific gravity of the mixture of sand and water varies from 1.55 to 1.60 which is always sufficient to float the lignite. The lignite goes out with the overflow and some fine sand is wasted with it. This waste sand will all pass a 50-mesh screen and most of it will pass a 100-mesh screen.



Type of jig which has been successfully used to remove shale from coarse gravel. The design shown here is for coal washing and modifications had to be made to adapt it to gravel washing

With normal running conditions there is a practically complete removal of the lignite but as in other forms of classifying and concentrating machinery a steady and uniform feed is essential for good work. This is secured in this particular plant by

having mechanical feeders electrically driven.

Lignite gives trouble in many plants along the Missouri and Mississippi rivers from North Dakota to New Orleans and as these are an important source of sand and gravel its removal will be of increasing importance. But it is not of such importance as the removal of shale, as shale is to be found in many sand and gravel deposits in various parts of the United States. In some cases a little shale seems to do no harm, in other cases it greatly injures the strength of concrete. It is said that the reason is that shale absorbs water and swells while the concrete is setting and hardening.

A good many experiments have been made to find a method of removing shale in a commercial way but none of them were very successful until the Link-Belt Co. tackled the problem about two years ago. The experiments were conducted by C. S. Huntington, of the company's engineering department, who has written the following brief description of the method for this review:

"It is obvious that no system of screening is able to differentiate between hard gravel and soft shale. In the preparation of coal, jigs have been used for many years to separate the coal from slate and similar material and it was thought that some form of jig might be used to separate shale from gravel.

"From the first samples submitted; the difference in specific gravity between shale and good gravel was found to be considerable. These samples had been partially dried in shipment. It was found that the shale absorbed considerable water when immersed for a short time and that the specific gravity was changed so that there was not such a great difference between wet shale and good gravel but still there was some difference. Any system of jigging must depend on the difference of specific gravity, of the materials to be separated, for its operation.

"In the jigging of coal, the slate forms the bottom layer of the bed and the coal the top layer. The larger proportion of material is of course the coal which passes off the top layer easily. In the separation of shale from gravel, this would be reversed. The gravel would be the heavier and form the larger percentage, and be on the bottom of the bed, while the shale would be lighter and in small quantities. The bulk of the material would have to travel rapidly across the jig and pass under the bed of shale. A Shannon jig was picked as the most suitable type but some changes had to be made in a standard jig to take care of the reversed conditions.

The Shannon jig (patented) consists of a tank containing water and in which a perforated bed plate surrounded by sides and proper baffles is raised and lowered. This action forces the water up through the perforated plate and stratifies the heavy and light materials.

"Suitable spouts and automatic draw-off valves with adjustable openings must be provided to carry away the shale and gravel after it is separated. Two elevators or other conveying mediums must be used to lift the separated materials out of the water and drain them before spouting to cars or bins.

"It was found that a fairly uniform feed must be maintained and that the gravel must be separated into several sizes and each size jigged separately. The usual grading in a commercial plant furnishes enough sizes for the jigging.

"It was found that by varying the stroke of the jig and the openings from the jig that the amount of shale removed could be varied as required. It was also found that in order to remove practically all of the shale that there must be a very

New dipper dredge installed by the Dixie Sand and Gravel Co. of Chattanooga, Tenn. This unusual type was adopted after trying other types and was found to be the best for the hard digging encountered

small quantity of the good gravel wasted with the shale.

"These experiments have determined that the separation of gravel and shale can be made to take care of state and federal specifications and at a cost that makes it practical.

"The difference in various gravels and shales is such that each pit must be investigated and studied to determine the proper construction of the jig for that particular deposit. There can be no standard machine which can be used anywhere."

Methods of Pumping and Dredging

THE most radical innovation of 1925 in dredging is the system adopted by the Ward Sand and Gravel Co. at Oxford, Mich. This system employs the ejector or hydraulic elevator principle, but the method of applying it is decidedly new.

The dredge pump is employed only to furnish water under pressure sufficient to give the needed impetus to the material. The discharge of the pump, which is clear water, goes down a 12-in. pipe line, the upper of the two shown in the diagram. It turns at the bottom through a U-bend and goes into a 6-in. nozzle which is placed inside the pipe. The water rushing from this nozzle and into the pipe beyond creates a partial vacuum, as in any ejector, and the suction pipe is connected to the 12-in. pipe at this point. The vacuum draws up material from the bottom as in any suction dredge. A jet head with pressure water helps to break up the material.

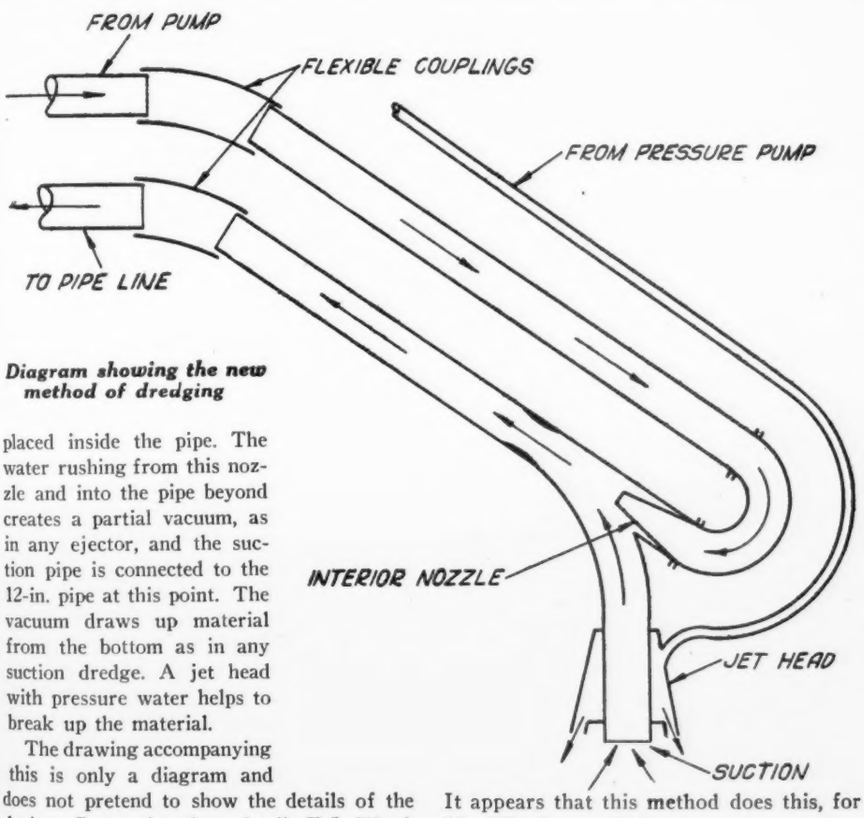


Diagram showing the new method of dredging

The drawing accompanying this is only a diagram and does not pretend to show the details of the device. Concerning these details F. L. Ward, president of the Ward Sand and Gravel Co., says that patents have been applied for to cover them, and he naturally does not desire to have them described in print until patents have been issued. In a recent letter to Rock Products he says:

"I might state that I am not at all interested in marketing this new idea and have no intention of offering my services to the gravel producing public at the present time. However, there are certain features which I believe should be given publicity as I believe that any mechanical contrivance which is an improvement on recognized efficient methods of handling material, should be given to the public as same may lead to further improvements. Improvements, I believe, are what has placed the United States in the front rank of nations."

The sand and gravel industry is not so much interested in details as it is to know if a new method of pumping has been devised which will obviate the expensive delays due to wear on pumps at a cost which will compare at all favorably with the commonly used methods. It appears that this method does this, for Mr. Ward says that:

"The operation of our plant under the new installation has developed the following facts:

"First—The cost per ton for power and labor is about the same as with our former dredge pumps.

"Second—The output of material has been practically stabilized. We have and can produce the required maximum tonnage each day. In other words, serious interruptions due to excessive abrasion and major accident have been eliminated.

"Third—We have learned that there is a direct ratio between power consumption and material produced with no additional change in equipment or costs when additional output is required, except the additional cost of power and labor to clean cars.

"This new method consists of a few new original appliances for which application for patents has been made, one of which has been granted; and as applied to the so-called hydraulic elevator. Combined with these ideas are refinements of methods in hydraulic operation which eliminate the major accidents and delays of that method.

"The financial results obtained this year in operating our new equipment, in spite of the fact that we did not and do not even now, thoroughly understand the most efficient means of handling our equipment, have demonstrated beyond any possible doubt that we have greatly improved upon the dredge pump operation."

The industry is fortunate in having a man like Mr. Ward who has sufficient courage and enterprise to test out a method so radically different from the usual methods. His success is bound to have a strong effect on the sand and gravel business since so many operations employ dredging.

The literature on the hydraulic elevator is scanty, but there is a record of one other instance of its application to dredging. This is in an article by George Massey of the Randolph-Perkins Co., which was published in Rock Products for February 7, 1923. It was a complete success for the conditions under which it had to work. It may be added here that, while the efficiency of a hydraulic elevator is considered to be low, there are certain things in favor of the system. One of these is that a pump for clear water has a very much higher efficiency than a dredge pump and another that experiments with the hydraulic elevator have convinced the writer at least that a study of the proper proportioning of parts and of the size of pipe to the volume of the discharge might result in giving the machine a much higher efficiency than has ordinarily been obtained.

New Dipper Dredge

The Dixie Sand and Gravel Co., a subsidiary of the Dixie Portland Cement Co. of Chattanooga, Tenn., installed a large dipper dredge to dig sand and gravel. It was built by the Bucyrus Co. and was put into service in May. Dipper dredges have rarely been used in the sand and gravel industry, hence it is worth while to know the reasons why such a type was chosen in this instance.

The first dredge operated by this company was a ladder dredge which carried a complete washing and screening plant including crushers. It was never a complete success, but the final reason for its

abandonment was that the government engineers objected to the waste from the washing plant being thrown into the river. Then a derrick boat with a 65-ft. boom and 4-yd. orange peel bucket was tried. This loaded the dug material and took it to a shore plant. It was a fairly successful dredge, but where the ground was hard it did not have sufficient capacity as the ground would not run to the bucket. So the dipper dredge, which is able to handle the hardest ground and to dig from a bank as well as from the bottom was the dredge to use, and this was the type finally selected.

The details of this dredge have been furnished by George Killian, secretary-treasurer of the company. The hull is 95 ft. long, 34 ft. wide, and 7 ft. deep, rectangular and with a square bilge. The stern is raked to facilitate towing. A stern spud and two forward spuds hold the dredge in place while digging is going on. The main machinery unit consists of a hoisting, a backing, and a stern spud drum gear-driven through friction clutches from a 10½x12-in. double-cylinder reversing engine fitted with Baker balanced valves.

The boom is of structural steel 52 ft. long and the dipper handle is of timbers armored on the top side and bottom with steel plate. The forward spuds are 30-in. square timbers armored on the corners with 6-in. angle irons and the stern spud is of 20-in. square timber. The spuds are 55 ft. long. The dipper holds 2½ cu. yd. and the machinery is designed to operate with a two-part hoisting rope reeving.

The working range of this dredge allows it to dig to a 30-ft. depth and to deliver material into scows placed alongside with a dumping height of 12 ft. above water level.

The crew consists of an operator, a fireman, craneman, deckhand and oiler. The oiler helps the deckhand in spotting barges, which is done with a steam capstan.

An ingenious method of working has been adopted so that the operator does not have to rack in to deliver to the scow. An empty scow is placed between the dredge and the scow to be filled, which keeps it 21 ft. away from the dredge.

Some large dredges have been built during the year. Notable among these is the new ladder dredge of the Keystone Sand and Supply Co. of Pittsburgh, Penn., built by the Dravo Construction Co. It has not yet been described in these pages. The dredge of the M. A. Callahan Corp., Cleveland, Ohio, which was later burned was perhaps the largest "straight" sand and gravel dredge which had been built up to that time. It contained an 18-in. pump direct connected to a 400-hp. motor. A description was published in the May 16 issue. The new clamshell dredge of the Willamette Gravel Co., Portland, Ore., was described briefly in the October 31 issue. This dredge is notable for the use of Diesel power and for its excellent design.

The seagoing dredge *Weston M. Carrol* of the Niagara Sand Corp., Buffalo, N. Y., was described in the October 3 issue. The *Sandmaster*, a sister ship to the *Sandcraft*, belonging to the Construction Materials Co. of Chicago will begin producing in 1926. It is equipped with Diesel engines.

Paragraphs from Producers

FROM one who reported decreased production: "Falling off of our output in 1925 due to weather conditions. Up to October 1 we ran ahead of 1924, but excessive rains and snow in our territory in October and November slowed the work down and demand fell off.

* * *

Things to be remedied in one Western state:

"Contractors bidding too low; too little *cash* down and balance paid when work is finished; too many temporary contractors and lack of legislation to make contractors take out a sufficient bond."

* * *

This is only one of many which say that plant capacity in the industry is more than is needed:

"The way the industry looks to me is that there are too many plants here in the ——— district. They have almost doubled their former capacity and still more plants have been built in the last two or three years.

* * *

From a Rocky Mountain state:

"We believe that the sand and gravel industry in this section of the country is only in its beginning and expect better business and better prices in the future."

* * *

From a well-known eastern producer:

"We are apparently increasing our output every year over the preceding year. We expect to increase business from 33⅓ to 50% over last year owing to the highway program and the prospective railroad ballast business."

* * *

A good reason to expect increased business in 1926:

"Highway work was retarded by bad weather in October and November, leaving many hangover contracts, and 1926 should show a larger yardage completed."

* * *

Quality and service gets the business:

"We believe that the producer that turns out a well-washed and properly-graded material will find a suitable market for his product. The demand seems to be stronger every year for quality and service."

* * *

Many a producer might have reported:

"While we have been very busy all the year, still our business was never a sure thing—always a hand-to-mouth proposition, but always working, not knowing one week what we were going to do the next. Still we produced more in 1925 than in 1924."

This is a shrewd reason for anticipating better business next year:

"Several local plants having covered all of their easy digging are forced to a more meager production at a greater expense. Our company is newly equipped to produce at least 2000 tons daily, therefore we anticipate larger sales next year."

* * *

Mixing poor sand and gravel with good is a "new one":

"A number of our customers are buying a cheaper product and mixing it. This cuts down the demand, which means a decrease in production and loss to us."

* * *

This is from a producer who knows the industry throughout the United States:

"The development of the sand and gravel industry in general has been along sound lines. There are more strong companies today than ever before. There is a very general movement toward the production of a high-class material to meet intelligent specifications. I consider the outlook for the industry to be very good."

* * *

The sort of experience that is the best teacher:

"Some new concerns here have had their experience and worked out their deposits and will not be the factors in 1926 that they were in 1924 and 1925. Sand cannot be produced at a profit to sell for 20c a ton at the pit. Those who have been in business here for the past 15 years know it—also from experience."

* * *

"Our business has increased steadily during the past eight years. We have this year increased our output of material 350% over our production in 1918 and have no reason to believe that this increase will not continue."

* * *

"This year, 1925, has been our biggest year, both for ourselves and (we believe) for our competitors. We believe present conditions will continue for at least another year."

* * *

"We have great faith in the future of all classes of concrete and in every kind of building, and as building cannot stop, the industry must grow."

* * *

"Ninety-five cents per ton for gravel to meet state highway specifications is too cheap, when the production is from deposits containing only 25% of gravel."

* * *

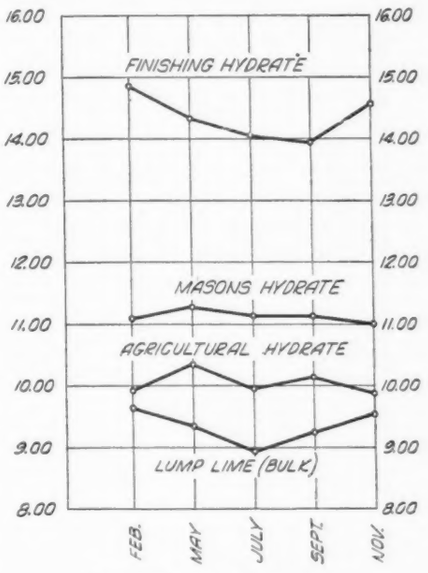
"To make a long story short, business is darned good and the outlook is better."

Lime Industry Shows New Life in 1925

Progress in Both Technical and Business Development—Record Production

OUR report of the lime industry in 1924 (ROCK PRODUCTS, December 27, 1924) may have created (and we know in some instances did create) doubt in the minds of readers whether the lime industry was really holding its own in the tremendous development being made all around us in building materials and in rock products generally. We are now more than glad to report that the year 1925 does show very appreciable progress made in the lime industry. It was the biggest year in history in lime production and in total value of output.

Production of lime in 1924 showed a slight decrease over production in 1923—the production in 1924 being 4,072,000; in 1923 it was 4,076,000. Prices in 1924 also showed about a 1% decline over 1923. This year—1925—two-thirds of the lime producers answering our questionnaire reported increases in production over 1924 ranging from 5 to 50%, the average being about 20%. About 14% of the producers reported less production ranging from 3 to 35%, with an average of 12%. The remaining 20% of the producers reported no change, or too slight a difference to note. This gives a general average increase for the industry as a whole of slightly more than 9½%. Of course, this is not a weighed average, but we believe it represents a fairly close estimate. Therefore our prediction is a total production of lime in the United States for 1925 of 4,450,000 tons, or the largest year's production in history. Probably the largest increases were in hydrated lime and particularly in the Ohio finishing hydrates.

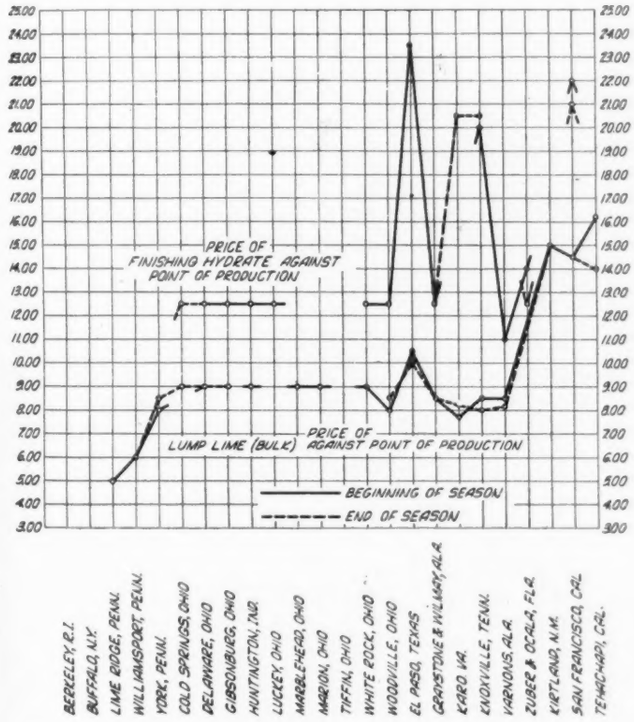


Seasonal price fluctuations

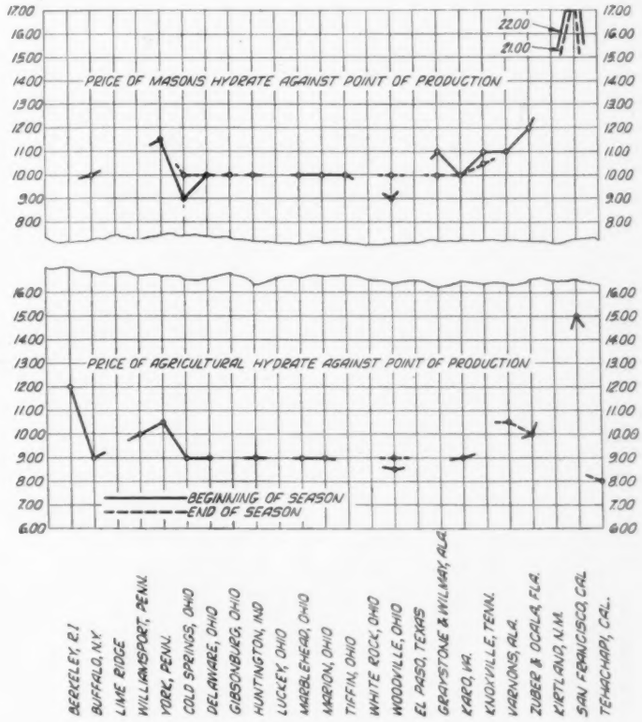
Prices, however, were very generally lower. Some 50% of producers reporting recorded price decreases ranging from 5 to 20%—an average decrease of 10%. A little more than 10% of the producers reported price increases of from 2½ to 8%, the average being 4½%. The others reported no change in prices. The average decrease in prices during 1925, as compared with 1924, was therefore nearly 5%. In other words, although 1925 was a record year for lime production the value of the year's output was about $41,160,000, or only something like $1,000,000 more than 1924.

Both building and chemical lime consumption increased appreciably. Competition was unquestionably keener and there is a noticeable tendency toward a concentration of business in the hands of the bigger operators.

As to the outlook for 1926 we have never known the lime industry to display so much optimism. Three-quarters of all the lime producers reporting look for increases in business in 1926 ranging from 10 to 100% above that of 1925. The average anticipated increase is 30%. Only two producers look



Prices of lump lime in bulk and hydrated lime in paper sacks, per ton, platted against point of production at the beginning and end of the season 1925



Prices of agricultural hydrate and mason's hydrate, per ton, platted against the point of production at the beginning and end of the season 1925

for a decrease; they evidently are figuring that their 10 and 20% increases this year were about those percentages more than a normal expectant year. One-fourth of those reporting expected price increases for 1926 ranging from 5 to 35% over 1925 prices, the average being 12%. Taking into account those who estimate their production in 1926 will be about the same as 1925, the average predicted increase in production for the industry as a whole is 20%, which we believe reflects optimism and hope, by at least 50%, rather than judgment, or conviction. In other words, we are optimistic enough to believe the lime industry may expect a 10% increase in production in 1926. Averaging guesses on prices in 1926 gives an expected increase of 1½% over 1925 prices. This is possible, as it would appear from our statistics that lime prices decreased proportionately more in 1925 than other rock products. It seems more likely, however, that lime prices will remain about at the same level as now until other rock products prices come down to about the same percentage of decrease over 1924.

Of course, with this increase in production expected, the great majority of producers believe the present rate of new building will be maintained for another year. The most encouraging phase of the lime industry, however, was the very considerable increase in consumption by metallurgical and chemical industries, heralding, we all believe, a permanent come-back of these industries following their post-war depression. Apparently the expanding use of lime for water, sewage, and trade-wastes treatment is accounting for some of the increased production.

Technical Developments

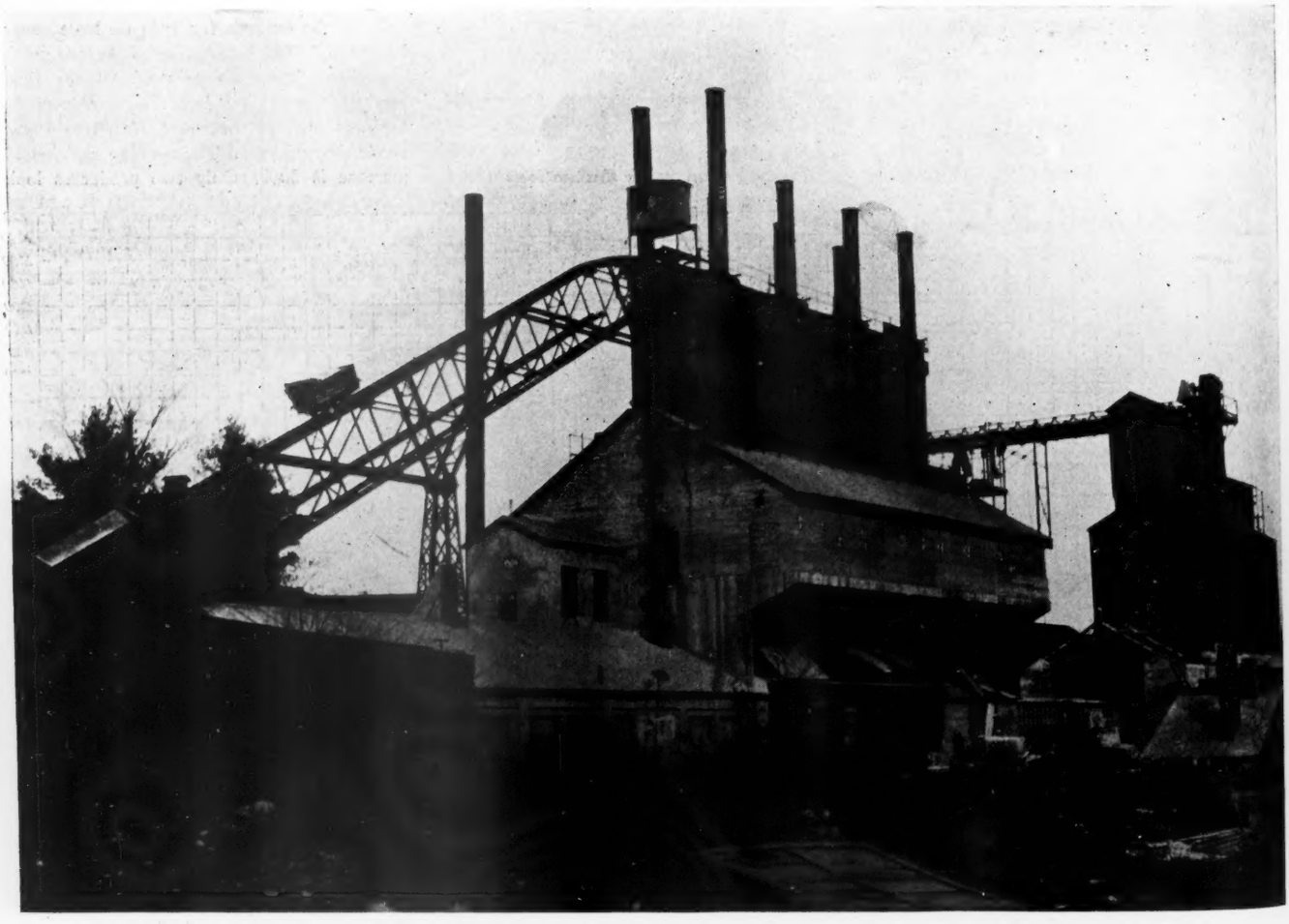
Although it is doubtful if we can properly classify it as a technical development, we believe the paper by Victor J. Azbe on "Some Factors Affecting the Operation of Lime Kilns," read before the May convention of the National Lime Association, and published serially in Rock Products since then under the title "Theory and Practice of Lime Manufacture" was one of the most important events of the year. Mr. Azbe is putting some of his theory and experience into practice in the design and construction of a new shaft kiln for the Peerless White Lime Co., at St. Genevieve, Mo., of which we shall have more to say later, when it has been thoroughly tried out.

Out on the West Coast, in Los Angeles, W. H. Barton, former general superintendent of the lime plants of Ash Grove Lime and Portland Cement Co., in Missouri, has designed and built a lime kiln for the Blue Diamond Materials Co., which will also incorporate many novel features.. A description of this we shall also publish when operating experience may be included.

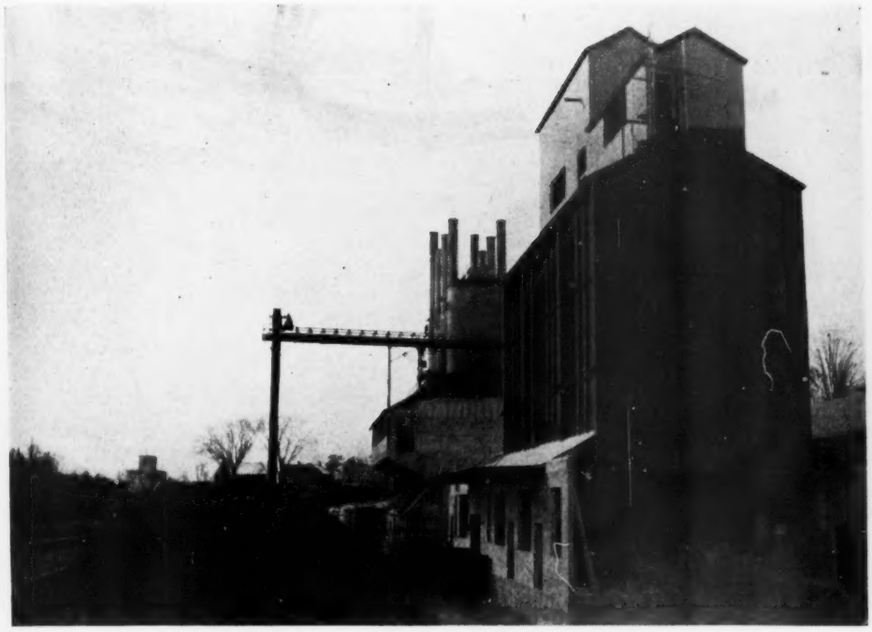
A third outstanding plant in the lime industry, and one which was commented on in our annual review of the lime industry, December 27, 1924, is that of the Champlain Valley Lime Co., Winooski, Vt. The work of developing, building, and experimenting with this plant has been continued all through this year, and some recent views are shown herewith.

This plant represents the latest work and ideas of that genius of the lime industry, John C. Schaffer, and will be one of the show plants of the country when completed. It is designed to make lime in shaft kilns with as little hand labor as it would seem possible in the operation of a plant of this type. It is too early for definite and reliable figures on operation; and the pulverized lime packing and shipping parts of the plant are not completed, and the hydrate part is not yet started.

One of the outstanding accomplishments of the plant is that it really is turning out a very high-grade finishing lime from a high calcium limestone with a 100% coal fire. It is claimed that no other high calcium



New shaft-kiln lime plant of the Champlain Valley Lime Co., at Winooski, Vt., completed in 1925—one of the outstanding developments of the year



Lime storage bins and packing plant for lump lime and pulverized lime at the Champlain Valley Lime Co. plant

lime plant, in the East at least, is doing this; wood fuel is still being used where a finishing lime is desired. We are unable to say that this is the *only* high calcium lime plant making finishing lime with coal-fired kilns, but it is nevertheless a noteworthy accomplishment.

A special feature of this plant is the mechanical handling of the lime from start to finish, and the provisions to handle two kinds of limes simultaneously. The stone varies so that all of the output of the kilns is not finishing lime. Therefore the conveyors under the drawing floor, the Pennsylvania hammer mill, the elevator, and the storage bins are all in duplicate. The hammer mill is a special design with two distinct compartments separately fed and discharging to separate divisions of an elevator to storage tanks.

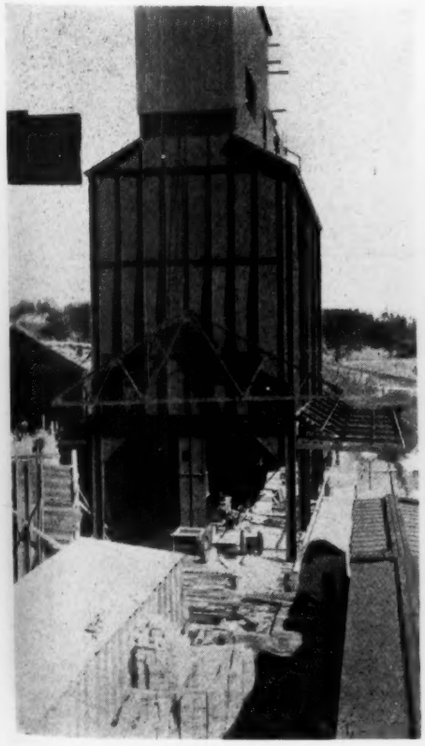
Practically Automatic Operation

Specially designed quarry cars, loaded by hand, are hauled directly up an incline from the quarry to the tops of the kilns by a 200-h.p. Lidgerwood hoist, electrically operated by remove control. The hoist operator is located in a tower over the No. 1 kiln, and, by means of a controller and foot pedal, has full control of hoisting and stopping the cars at any point. A specially designed counter-weight, pull-back system automatically connects to the car at the top of the incline and provides the power for returning the car to the incline. The hoist motor acts as a brake on the descending car and enables the operator to control the speed of descent. The pull-back device automatically disconnects when the car is at the top of the incline.

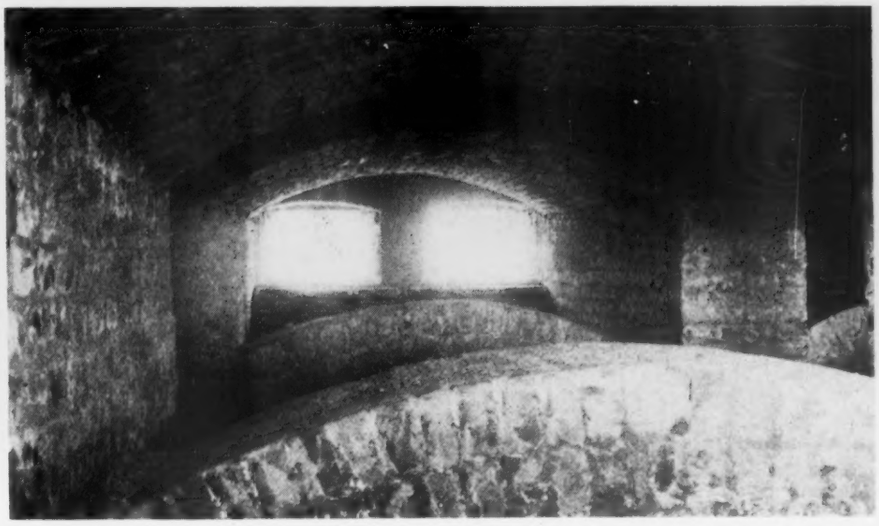
Installing the vertical 150-h.p. water-tube boiler

A new type of Howe scales is installed on the incline to weigh the cars as they ascend. It is only necessary to stop them long enough for a dial pointer to come to rest. These scales are so designed that they give correct weights of stone, compensated for the angle of the incline and the pull of the rope.

The incline itself is of unusual design, having only one intermediate support between the concrete base and the tops of the kilns, which are 90 ft. above ground level. It is provided with a steel hopper through which the quarry cars may be emptied into motor trucks, when stone is wanted for any purpose.

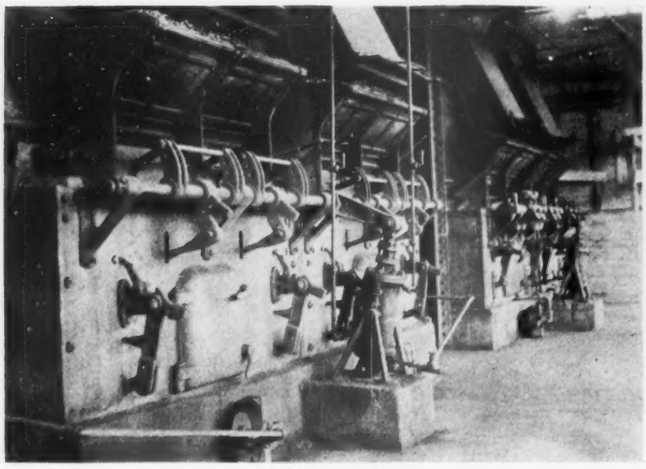


Lime storage and packing plant from the kilns

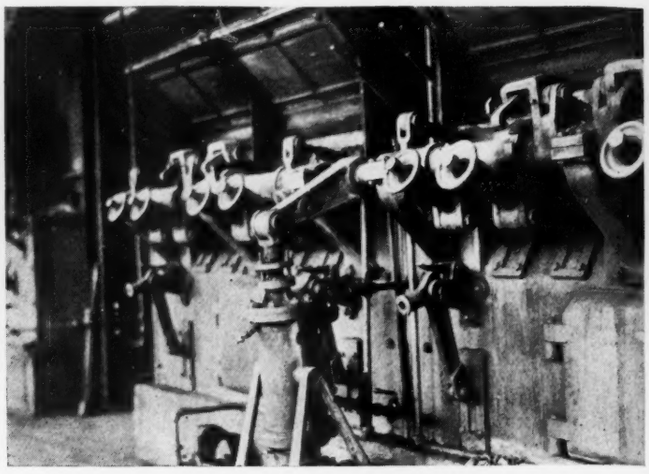


Interior view of the furnaces of the Winooski kilns, showing very wide arches

The Winooski, Vt., Plant of the Champlain Valley Lime Company

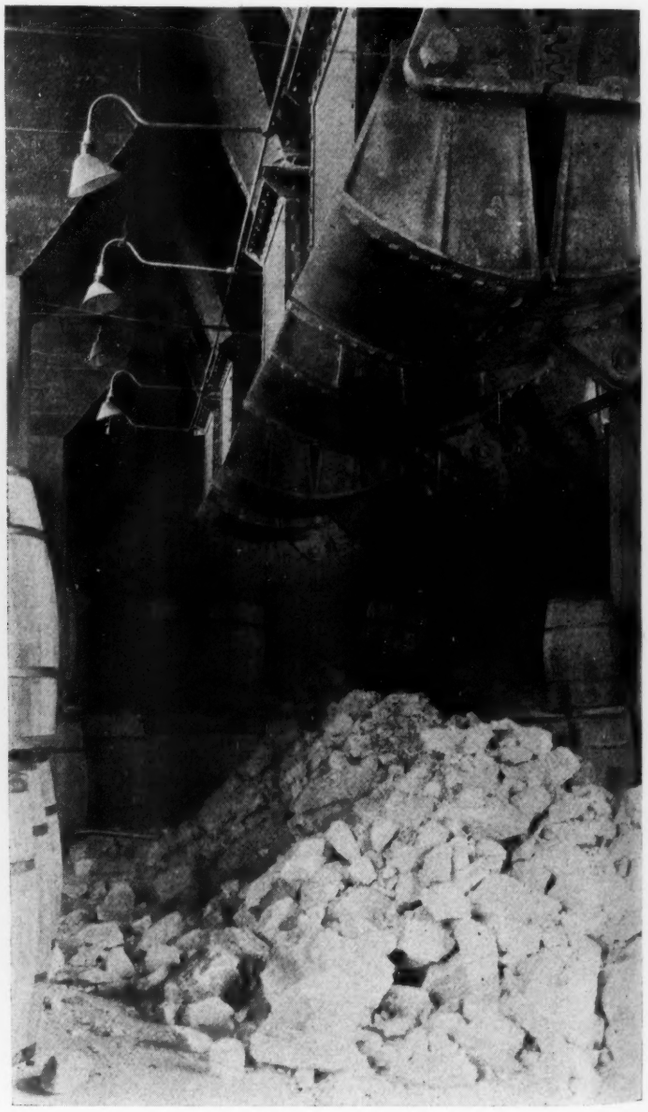


No. 3 kiln equipped with automatic stoker of the type first found successful

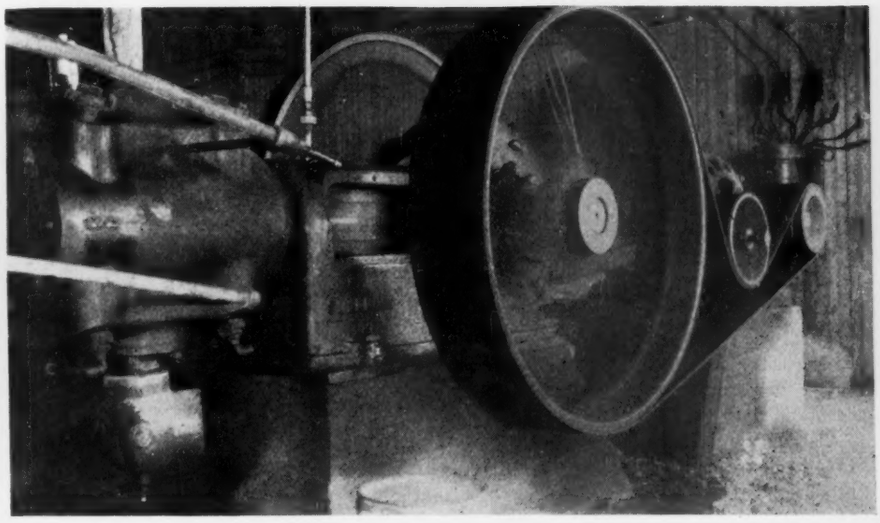


No. 4 kiln with an improved type of automatic stoker of the same character as on the No. 3 kiln

Pneumatic cylinder and pistons on the draw shears of the Winooski kilns



Another view of the draw shears and drawing mechanism



Air compressor for plant operation and quarry drills

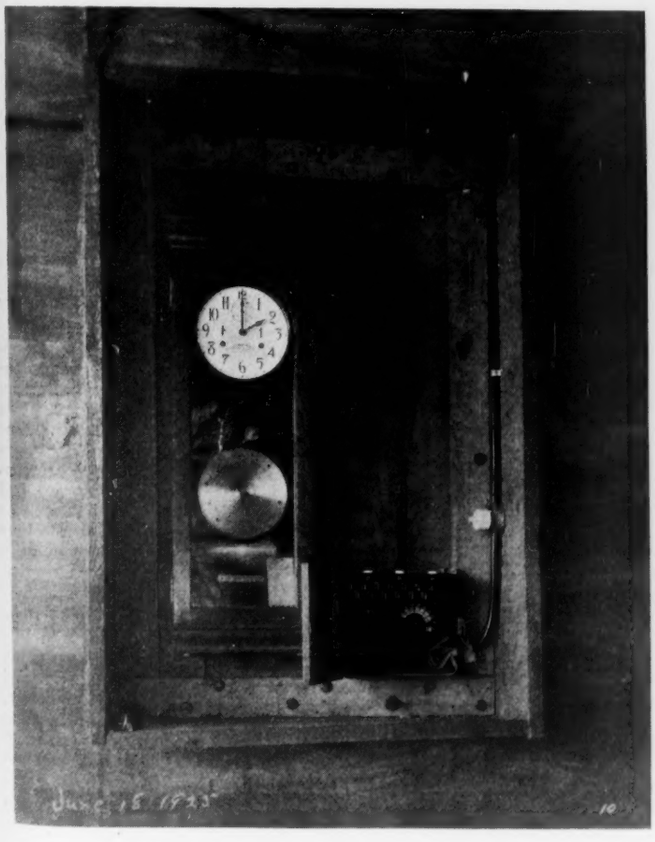
Locomotive-type air compressor for plant operation alone

Power Plant

Being automatic in operation means the consumption of more power than is customary around shaft-kiln lime plants. Compressed air is the principal vehicle for transmitting the power. The quarry drills, the draw shears, and the stokers on the boiler and kilns are all operated by compressed air furnished by an electrically driven Sullivan compressor and a steam-driven locomotive type Westinghouse compressor mounted on the boiler. The two together have a capacity of 420 cu. ft. per minute, running in tandem. The Westinghouse compressor takes care of the draw-shears and stokers at night when the quarry is not in operation with 150 cu. ft. of air per minute.

The boiler is a 150-h.p. Wickes vertical water-tube type, equipped with a McClave feed hopper and grates. It is installed to furnish steam for the operation of the lime kilns.

The kilns have many novel features. In the first place they are among the largest shaft kilns in existence—17 ft. 3 in. in diameter by 90 ft. high, with a lime capacity of 40 tons daily, it is claimed. They have a



Specially designed clock with electric contacts which controls the operation of the automatic stokers

Another view of the No. 3 kiln showing the coal feed hoppers and steam and air injectors (side)

very large storage and preheating zone, what their designer, Mr. Schaffer, calls the "acidulating zone," where under conditions of moist heat the stone is supposed to be chemically affected, a calcining zone of extraordinary depth, and a very large cooling zone. (An approximate longitudinal cross-section of one of these kilns is illustrated on one of the pages of the section of this issue devoted to new machinery and equipment. Each holds approximately 376 tons of stone in various stages of manufacture into lime. A special feature of these kilns are ducts in the upper part of the kiln lining to remove a part of the kiln gases and insure sufficient draft notwithstanding the deep storage of stone over the calcining zone. The almost total absence of smoke from the stacks at all times is pretty fair evidence of unusually complete combustion. The tops of the kilns are sealed.

Automatic Stokers

After several trials and experiments the Nos. 3 and 4 kilns have been equipped with satisfactory automatic McClave stokers, fed from hoppers overhead, which are in turn kept filled from an adjoining coal storage by bucket elevator and conveyors. The stokers are automatically operated by pivoted pneumatic cylinders and pistons by means of a specially designed time clock with electrical contacts. When the plant was visited the latter part of November the time interval between piston strokes was about 5 minutes. The piston action is comparatively slow and steady. Two men and a foreman on the firing floor take care of the firing of the entire battery of kilns.

Drawing Operation

Each kiln is drawn through two pairs of segmental gates or draw shears, each pair operated by a pivoted pneumatic cylinder and piston. At present (November) the lime is dropped on the concrete floor and sorted and packed by hand; but the ultimate handling of it will be entirely automatic, as already described. A Webster pan conveyor, in duplicate, runs under the floor, the one side to handle finishing lime, the other mason's, or ordinary lime. The conveyor takes the lime to the two-compartment Pennsylvania hammer mill, already referred to, and it is then distributed to separate compartments in steel storage bins.

Lime will be loaded out of the bin compartments by pan conveyors, which deliver it to a Manierre box car loader; or the lime may be drawn out by special spouts into barrels, which will rest on scales depressed to floor level. Lime from any of the compartments in the bin may be withdrawn to feed a second Pennsylvania hammer-mill, installed to make pulverized lime. A Hum-mer screen will separate the crushed lime into three sizes. The oversize is returned to the mill and the other two sizes may be stored in another bin with separate compartments, or sent direct to the hydrating plant, when built.

Under the pulverized lime storage bin will be four Howe barrel packers. Special feeders and gates under these bins will also provide for loading box cars with bulk lime, or feeding a conveyor to the future hydrate plant.

Rotary Kiln Developments

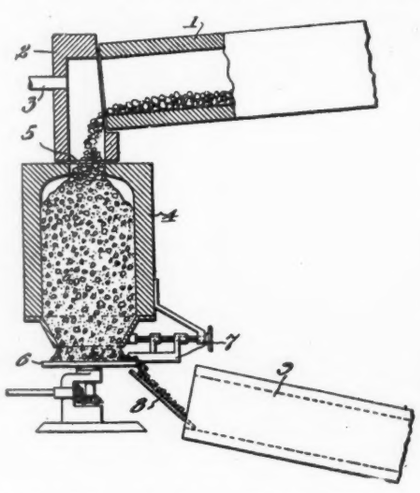
Lime manufacture by the rotary kiln method has by no means been standing still during 1925. One prominent lime manufacturer prophesies that in ten years all chemical lime will be made by the rotary-kiln method, but that in the meantime much will be learned in regard to rotary-kiln operation.

One new rotary-kiln lime enterprsie has been added to the industry during the year —that of the Mohawk Limestone Products Co., Jordanville, N. Y., which will soon be producing. (We shall have a description of this plant in the near future.) The kiln is 8x120 ft., burning pulverized coal. This enterprise is chiefly interesting to the lime industry because it is backed and managed by the J. G. White Management Corp. of New York City, which in turn is associated with some of the biggest financial interests in New York. It therefore marks recognition of the possibilities of the lime industry by investment bankers.

The lime industry has otherwise been signally recognized by bankers in the floating of securities for the New England Lime Co., Pittsfield, Mass. (over $1,000,000), which operates two rotary-kiln lime plants. These securities were placed in the hands of investors scattered over the larger part of the United States.

The Marblehead Lime Co. at Chicago is building a new rotary-kiln lime plant in South Chicago. The initial installation will be two 9x175-ft. kilns using oil fuel. Ultimately there will be six kilns.

The American Lime and Stone Co., Bellefonte, Penn., is adding a second 9x175-ft. rotary kiln. This installation is particularly interesting because of a special feature designed and patented by Irving Warner, vice-president of the company, variously known as a soaking pit, fireless cooker, and seasoning pit. It was described, according to the patent specifications, in Rock Products, July 11, 1925. It is intended primarily, we believe, to eliminate core in the production of rotary-kiln lime—a problem that has always been present in the lime industry.



Irving Warner's device for insuring complete calcination of rotary-kiln lime

Proposed Improvement of Rotary Kiln Process

The theory of this device has subsequently been explained by Mr. Warner in the *Warner-American News* as follows:

Heretofore, lime discharged from rotary kilns has invaribaly been subjected to prompt cooling. This has been done either by providing a cooler, usually a rotary, or cooling takes place naturally by exposure to the air in the elevating and conveying machinery.

Observations, tests, and mathematical calculations, now indicate that this procedure is a mistake. Accordingly, the new Bellefonte kiln will discharge its burnt product to a chamber which is carefully insulated and so designed as to exclude the passage of air. This chamber will hold about 15 tons of lime so that it represents from two to three hours' operation of the kiln. This gives the lime a soaking heat for this length of time, improving its physical condition and driving off additional carbon dioxide.

The lime is then fed out the bottom at the same rate that it enters the top, to an elevator to pass through a rotary cooler for cooling in the usual manner.

It will require a neat layout to feed the lime out as fast as it goes in. For otherwise, in the course of time, the pit would either empty itself or overflow. This will be accomplished in the following way:

The elevator which lifts the lime to the cooler will dip into the hot lime at its natural angle of rest. This elevator will be driven by the kiln itself, starting, stopping, and varying speed together. Then a vertical slide gate may be set by the kiln operator to change the height of the slope of lime, thereby determining how full the elevator buckets shall be. After the operator has once set this gate, further adjustments should be infrequent, unless there is a change in the depth of stone carried in the kiln itself.

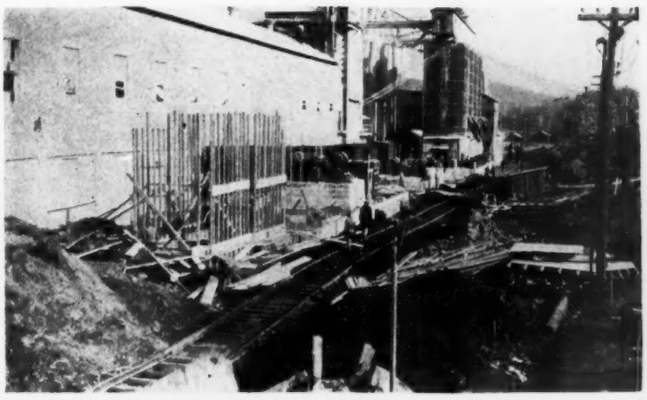
In practice, however, the elevator will be set to take away slightly less lime than is entering. An overflow point will be provided whereby the small excess quantity will fall directly into the elevator pit.

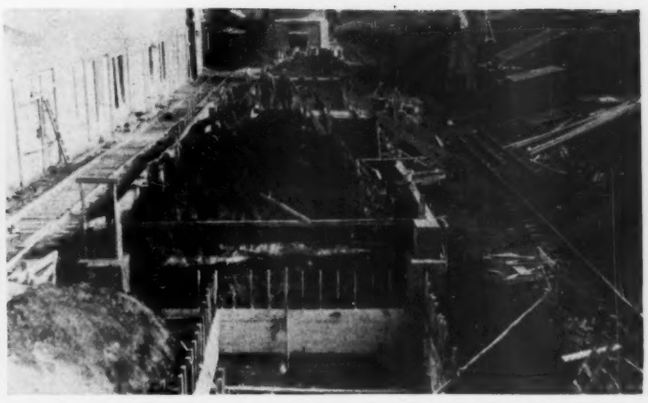
What can we accomplish with this seasoning pit? We don't know exactly yet, since this is the first full-sized installation. But in the early days of tuning up the first Bellefonte kiln, it was noticed that the lime sampled at the end of the cooler seemed to be better than a sample taken directly from the discharge end of the kiln. Also we had great difficulty in driving out the last 2 or 3% of carbon dioxide, even though the lime being discharged from the kiln was at a very much higher temperature than that actually needed to decompose the stone.

Accordingly, we mentally connected these two puzzles. The lime was leaving the kiln at a higher temperature than necessary, but on the way down through the hood and chute and in the upper part of the cooler, some of this excess heat went on burning a little bit more of the core. It was not much, but enough to be observed occasionally.

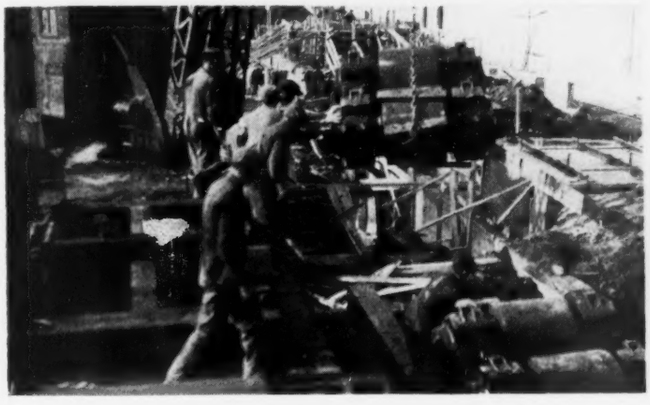
Thereupon some calculations were made which were both simple and illuminating. Here is the way it worked out.

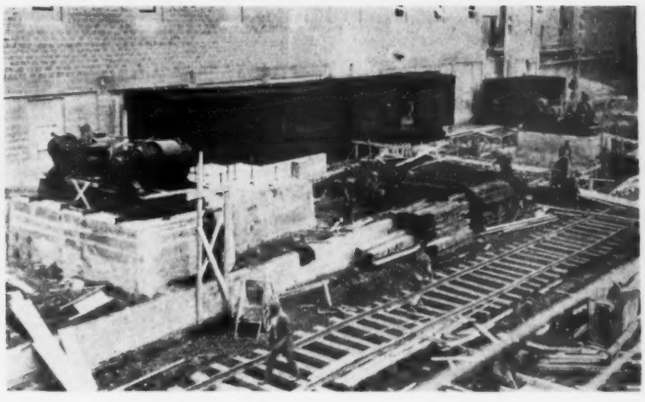
The lime was discharged from the kiln at a temperature of 2250° F. But lime



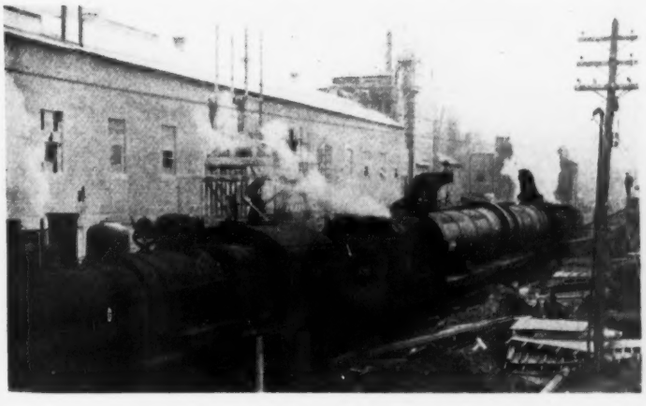


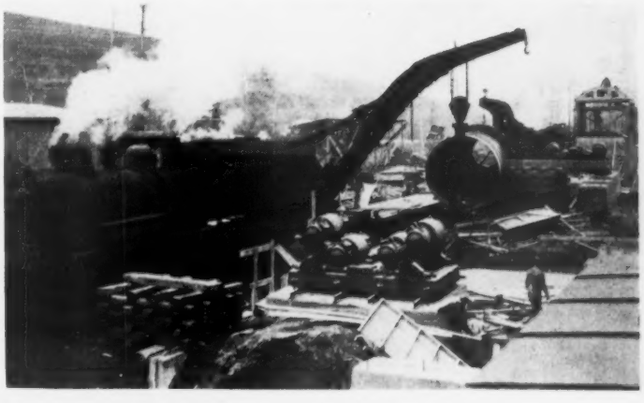
Adding No. 2 rotary kiln to the plant of the American Lime and Stone Co. at Bellefonte, Penn.



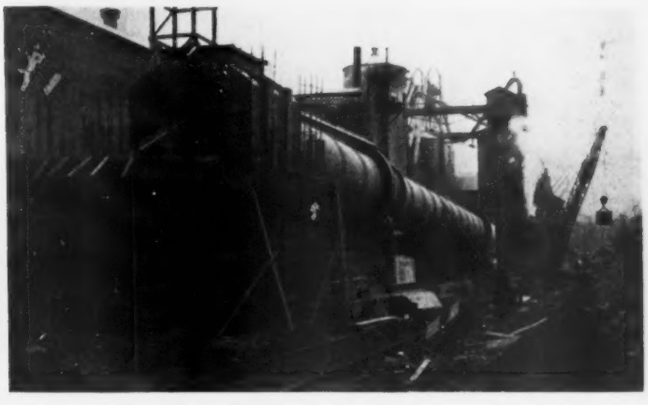


Kiln bearings and concrete supports completed—Views taken during November at Bellefonte

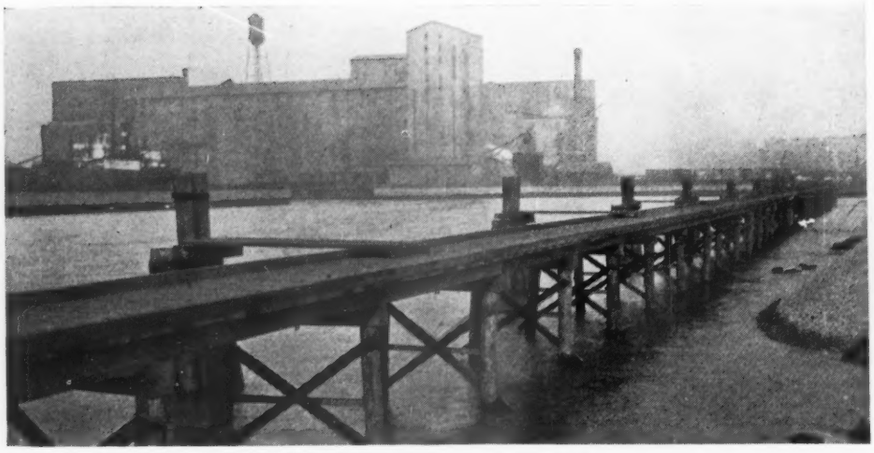




Bringing in and erecting the 9x175-ft. rotary kiln showing unusual construction facilities



The kiln erected, and on the right, being equipped with hood and burner mechanism



Wharf of the Marblehead Lime Co., South Chicago, one of the first of this type to be built in this locality

burns at only 1650° F. So that there is an excess temperature of 600° F. The 100 lbs. of lime heated an extra 600° F. carries surplus heat to the extent of 13020 heat units. But it requires only 1750 heat units to drive off 1 lb. of carbon dioxide, so that the 13,020 heat units available will drive off 7 lbs. of carbon dioxide.

Furthermore, 7 lbs. of the gas, carbon dioxide, means almost twice that much core, to be exact a little over 12 lbs. of core or unburnt limestone.

Tests were made by catching hot lime in a chamber and analyzing before and after seasoning. Some of the tests showed an improvement and others did not. Then it was we made the obvious discovery that the season-pit should be very helpful to a kiln in good working condition, but was of no help to a kiln in bad shape, simply because, at such time, there was no excess heat available to cook out the carbon dioxide.

A patent has been granted covering this process. We anticipate that it will enable the operators to run the kiln good and hot all the time and then drive the kiln fast and with a heavy load so as to avoid injuring the lining and the lime itself. Under ordinary conditions a kiln operated in this manner will make too much core, but with the seasoning pit, this core will be eliminated and the lime itself will come out in better physical condition due to hot seasoning and slow cooling.

New Plants

Probably the largest new lime plant completed during the year is that of the Chazy Marble Lime Co., Chazy, N. Y., with a battery of 12 standard Arnold and Weigel kilns, and a two-unit hydrating plant. This is a high calcium lime operation. Another high calcium lime plant under construction in the East is that of the New England Lime and Portland Cement Co. at Rockland, Me. A new Ohio dolomitic lime plant, that of the Bruns Hydrated Lime Co., Woodville, Ohio, is in the process of construction. The U. S. Gypsum Co. completed and put into operation in June one 8-shaft kiln lime plant at Cordova, Ill. The hydrating plant has a daily capacity of 125 tons of mason's high calcium lime hydrate per day. This company will build a $150,000 lime plant in North Canaan, Conn., in 1926.

In the Southwest the Batesville White Lime Co., Ruddells, Ark., completed a 3-kiln plant and a hydrating plant, chiefly notable from the fact that a 100-h.p. Type V Fairbanks-Morse diesel engine is used as a prime mover. Florida is fairly well supplied with limestone and the expansion of the lime industry has kept pace with the expansion of business there as a whole.

The industry suffered some loss in producing capacity from fires at the Moores Lime Co. plant, Springfield, Ohio, the Burton K. Harris Lime Co. plant in Rhode Island, the Cutler-Magner Lime Co. plant at Duluth, Minn., the Cox Lime and Stone Co. plant at Conhohocken, Penn., and one of the plants of the Western Lime and Cement Co. in Wisconsin. All of these plants have been rebuilt, or are under reconstruction at the present time.

Another view of wharf and connection with bank—Self-unloading steamers will lie along the wharf and stock stone on the shore parallel to the wharf

Our records show that there were about 30 new incorporations in the lime industry in 1925, the total capital of which amounted to about $12,000,000.

A significant development, although not a very conspicuous one, has been the installation of many new hydrating plants in all parts of the country from New England to Montana and California. Lime manufacturers everywhere are finding a demand for hydrate, even in territories where heretofore lump lime has filled every requirement.

Construction progress on the Marblehead plant on the first of December

Pertinent Paragraphs by Producers

"Of course we look for improvement each year—hope for it at least (New England)."

* * *

"1926—a big year (New York State)."

* * *

"Beginning the first of the year trade in chemical lime was very quiet. The last half of the year was better, and we think we will manufacture considerably more lime

Progress on the South Chicago plant of the Marblehead Lime Co. on December 15

than last year. Prices were not quite as good as last year (New York State)."

* * *

"Lime business below normal (Pennsylvania)."

* * *

"A 20% increase in agricultural lime output (Pennsylvania)."

* * *

"Fuel outlook uncertain. Should anthracite strike continue bituminous coal and coke prices may further advance and curtail general business. Labor troubles will probably increase, resulting in higher wages next spring. This and increased fuel cost will decrease demand for commodities (a Pennsylvania optimist).

* * *

"My consignees operating to better capacity at the moment (December 15) than they were some months ago and future looks good (Pennsylvania)."

* * *

"There appears to be an indication of greater demand for chemical lime for 1926 than in 1925 (Virginia)."

* * *

"Labor is higher, also scarcer. The Florida building and highway construction programs are enormous. The Florida railroads are doing much to improve and enlarge facilities. The coastwise cities are also improving port facilities. Florida is looking forward to a better year than ever before (Florida)."

* * *

"The south is coming to its own, with the exception of Florida which already has its own and is about to lose some that is not its own. In looking over the prospects we firmly believe that the south will offer more to capital than any other section of America, in that it has iron, coal, oil, cotton; and general conditions in the raw material markets are better (Alabama)."

* * *

"Our business this year has been very good but not abnormal in demand. We hope to increase our capacity next year (Missouri)."

* * *

"Overproduction is wiping out profits (Ohio)."

* * *

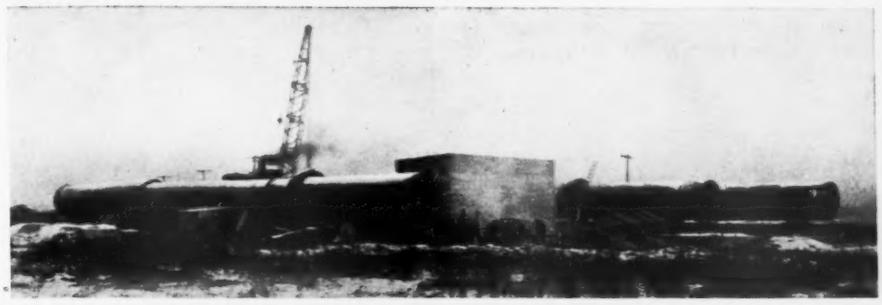
"We have confidence in the future. The use of lime and limestone products is increasing. There is some danger that increased productive capacity may affect market prices to such an extent that the prosperity of the industry may be put in peril, resulting in a conflict for the survival of the fittest. Such a condition, if it comes, will be brought about by those producers who are least able to weather the storm (Ohio)."

* * *

"The increased production in all lines should tend to bring about greater activity in construction during 1926. The improvement in business generally (agriculture, steel, coal, transportation) should tend to help the construction business. The reduction in taxation should also have a good moral effect on business, as well as the demand for better homes, schools, theaters, hotels, churches, etc. (Ohio)."

* * *

"There has been some increase in building this year (Utah)."



Placing the 9x175-ft. kilns in place at Marblehead plant

Lime-Cement Mortars For Cold Weather Use

TESTS recently conducted at the University of Wisconsin, under the direction of the Engineering Society of that state, demonstrated that lime-cement mortars are most satisfactory for use in cold weather. Eight lime and portland cement mixes and four bricklayers' cements were tested under air storage conditions, which approximated ordinary field conditions.

Mortar mixed in the proportion of one part portland cement, two parts of lime, and nine parts of sand by volume gave uniform satisfaction under both warm and cold storage conditions and had a high rating in shear, tensile and compressive strength. The high plasticity of this mix also played an important role in its selection as first on the list of mortars recommended by the committee.

The conclusions drawn by the committee in charge of this work are:

1. With all cements save one, freezing decreased the bond strength of the mortar to the brick. In most cases this decrease was very marked. In the exceptional case, where there was no apparent injury due to freezing the bond strength after curing in warm or freezing temperatures was very low.

2. Curing at low temperatures just above the freezing point of water adversely affected the bond strength to a less extent than during under freezing temperatures.

3. Basing judgment on the unit stress at flaking of mortar, it appears that curing at temperatures near the freezing point had little effect on the crushing strength of the mortar in the bonded brick. On the other hand, freezing appears to have had a weakening effect on the crushing strength.

4. From the above evidence it appears that freezing is detrimental to the strength of mortars commonly used in bricklaying.

5. From the standpoint of strength the mortars shown in Tables A and B gave the best results.

TABLE A

	Portland cement pts. by vol.	Hydrated lime pts. by vol.	Sand pts. by vol.
Mortar No. 1.....	1	2	9
Mortar No. 2.....	1	1	6
Mortar No. 3.....	2	1	9
Mortar No. 4.....	1	....	3

TABLE B

	Portland cement pts. by vol.	Quick lime paste pts. by vol.	Sand pts. by vol.
Mortar No. 1.....	1	2:3	6.7
Mortar No. 2.....	1	2.3	10.0
Mortar No. 3.....	1	1.5	5.0
Mortar No. 4.....	1	1.5	7.5

Of these mixes, mortars of the No. 1, No. 3, and No. 9 type are the most economical. Mixes containing equal volumes of cement and hydrate (or paste), though somewhat more costly, were stronger, especially at one month.

6. Mixtures of lime and portland cement were much more plastic and easier to work than the mortar made with portland cement and sand. The mixtures containing equal parts of hydrated lime and portland cement and one part hydrated lime to two parts portland cement exhibited considerably higher adhesion to the brick than the portland cement mortar.

The Agricultural Limestone and Rock Phosphate Situation in the Grain States and Particularly in Illinois

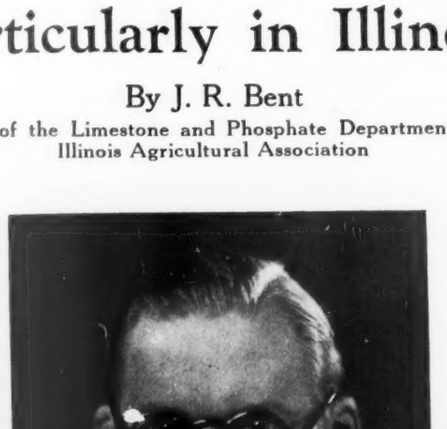
By J. R. Bent

Manager of the Limestone and Phosphate Department of the Illinois Agricultural Association

AGRICULTURAL limestone is no longer an experiment. The practice of using it for soil building and maintaining purposes is here to stay. As an essential in good farm management it will receive more and more attention from the farmer as time goes on and its production and distribution will occupy more and more a prominent place in the quarryman's scheme of operations and sales.

Agriculture is one of the oldest, if not the oldest, industry. As an art, it is very old. As a science, it is comparatively new. These are basic facts with which we are all familiar. Under agriculture as an art some form of lime has been applied to the soil as a beneficial conditioner for generations, but scientific knowledge covering its action, the reason for the results secured, and the best form and way in which it should be applied is comparatively new. The burning of lump limestone in order to make caustic lime is an industry that has been practiced for centuries. Not only has such lime been used for construction purposes and in the arts and sciences, but in the past and in the older agricultural regions it has been the prevailing, if not the exclusive form in which calcium has been applied to the soil and an alkaline condition maintained. It would be a mistake to jump to the conclusion that this is a practical demonstration or proof of its superiority over raw limestone for soil treatment. The real reason that raw limestone has been used in comparatively recent years lies only in the fact that the mechanical equipment and industrial means under which stone can be economically reduced to fine sizes are developments which have taken place within the recollection of the present older generation.

The manufacture and the use of explosives are not new, but the possibilities and effectiveness of explosives in the quarrying industry were decidedly limited until the advent in recent years of the power driven drill. Quickly following this development came the invention and development of, first, the power crusher, then pulverizing and milling machinery. It is, therefore, only in recent years that it has been possible, at a reasonable cost, to prepare raw limestone or reduce it to a degree of fineness suitable for application to the soil. Prior to that time, the only form in which the non-caustic or carbonate form of lime could be applied was as chalk, marl or



J. R. Bent

air slaked lime, and the available supplies of these were too limited in quantity and distribution to constitute much of a factor in comparison with the need.

The Future of Agricultural Limestone in Illinois

The writer does not wish to be understood as opening a discussion or debating the relative merits of the different forms of liming material from a scientific standpoint or to be posing as an agronomist or scientist. He desires simply to review the present economic situation and, so far as possible, to foresee the future as regards the supply of and the demand for agricultural limestone, particularly in Illinois. In doing so it is necessary to outline the theory upon which the present development and the forecast rest.

It is a well known fact that the fertile soils of the earth are the broken down limestone soils. Nature did not make these soils by first burning the limestone to the caustic form nor by applications of finely ground or pulverized material at stated intervals. Instead it was accomplished by a gradual breaking down and distintegration of the coarse material. Some scientists hold the view that the "mass action" of a quantity of very quickly available material, such as caustic lime, hydrated lime or finely pulverized limestone, has a distinct tendency to "lock up" or depress (at least temporarily) the availability of the natural phosphates and the potash salts found in the soil. We seem to be imitating nature most closely if we maintain our soils and supply them with an abundance of slowly available material, such as relatively coarse limestone, rather than to allow them to become excessively acid and then to attempt to restore them rapidly. These are some of the considerations that actuated the University of Illinois when it advised the use of liberal amounts of inexpensive limestone screenings rather than small amounts of much more expensive, quickly available material.

Use of Limestone Promoted by Farm Bureaus

In Illinois the project of soil building and soil maintenance has been, from the start, one of the major projects of the farm bureau movement. The farm bureau movement received a great impetus during the late years of the war and by the demand for increased agricultural production as a result of the war. Keeping step with the development of the farm bureau movement in Illinois, and as a natural fruit thereof, came the development of the use of agricultural limestone in the form of limestone screenings. In 1911 Illinois used 32,000 tons of agricultural limestone. By 1919 the tonnage had grown to 350,000. In 1920 and 1921 (due to the farmers' deflated condition) it dropped off to less than 250,000 tons. Since that time the demand has been growing rapidly until in 1924 Illinois broke its own record and that of any other state by using 525,000 tons (which, according to government statistics, was at least a quarter of all the agricultural limestone used in the United States that year). The figures for 1925 have greatly eclipsed those for 1924, however, as the farmers of Illinois, during 1925, used somewhat in excess of 750,000 tons. Large as these figures seem and large as they are, compared with previous records they are, nevertheless, small when viewed in the light of the depletion to which the tillable soil is being subjected by leaching and drainage. It is estimated

that the Mississippi river alone is carrying to the Gulf of Mexico *annually* in the neighborhood of 20,000,000 tons of calcium and magnesium carbonates leached from the soils of this state.

There are several reasons for the great growth of the use of agricultural limestone. First, may be mentioned the promotional and educational work of the farm bureaus and the extension department of the state agricultural station—the Farmer's Institute, etc. Second are the results which the farmers have observed from the use of limestone on their soils. Third, there has been a gradual overcoming of that characteristic of human nature which, for want of a better expression, we will term "the inertia of public reaction." The writer believes that this last factor, now that it has been set in motion, will be an increasing influence in favor of the use of limestone, as time goes on. There has been a fourth factor which has had a very far reaching effect in the great development that has taken place in Illinois. It is, the reciprocal relationship which has been established between the quarry operators and the farm bureaus. Never before have the producers and the consumers of agricultural limestone each understood the other's problems so well, and the two groups been so close together as they are today. As the farm bureaus have been the greatest agency in the development of the market for agricultural limestone and as the bureaus have been supported financially by the dues of the members, the quarry operators in the Illinois territory have recognized the propriety of extending to the farm bureau member a moderate discount in the price which the latter pays for his limestone. As a condition the farmer is required to make prompt payment. Under this plan the effective promotional work of the bureaus is stimulated; the principle class of limestone users is gratified and the quarry operator increases the volume of his sales, cuts down sales expense and insures prompt payments.

Screenings No Longer Available in Sufficient Quantities

In view of the rapidly developing demand —especially now that the available supply of "screenings" is no longer adequate—it is but natural that there should be a tendency for the price to advance materially. To the extent that the ruling price may not have been sufficient to take care of a ratable share of the cost of production, on the quarry run basis, such a tendency to advance prices might seem to be justified. There are, however, other considerations, which the quarry operators of the Illinois territory, very wisely have kept in view in following a conservative course on price policies during this period of development. With the available supply of screenings inadequate to meet the developed demand, additional material must be brought in or produced. Should there be a heavy advance in price, commercial quarries in neighboring states farther from the boundray line, would come into competition. The portable or semi-portable type of plant owned and operated by local associations of farmers, has always been more or less of a factor in some districts having satisfactory local deposits, but so long as the delivered cost of railroad shipments from the commercial quarries is low or reasonable, such portable plants cannot, and do not, compete. Their serviceability under present conditions is not indicated, excepting in localities which are remote from a railroad station or where an expensive or annoying wagon haul is encountered. Just to the extent that delivered costs of limestone from commercial plants may advance, such portable plants will become more and more a factor.

Mine By-product "Chatts" Become a Competitor

A supplemental supply which developed during 1925 was that of by-product "chatts" from the lead mining industry in the Bonne Terre and Flat River district of Missouri. Between ten and fifteen thousand tons of this by-product came into southern and southwestern Illinois during the latter half of 1925. This material, which is relatively free from dirt and other impurities is, however, limited to a very narrow range in its sizing, it has little or nothing coarser than 10 mesh, and practically nothing finer than 80 mesh. The lead ore is treated by a wet process which leaves the by product chatts in a rather saturated condition. The chatts which are the discarded gangue of the lead ore, are dolomitic limestone and as such are not so easily soluble as the standard high calcium stone of the southern Illinois district, with which they come into competition. All of these considerations do not condemn chatts as an agricultural limestone, but they do indicate that their value is somewhat less than the agricultural limestone from some other sources. The lead companies producing and selling the chatts have recognized this difference in value, in the lower price which they ask for the material.

Perhaps the most logical way to meet the increased demand for agricultural stone is for the existing quarries to resort to direct pulverization, making the product as much like the ¼-in. screenings as possible. Such a product doubtless would cost more to produce than the price at which screenings have been sold from many sources heretofore. One way of meeting this situation would be to have two products—selling the screenings at a relatively low price and the pulverized stone at a price sufficient to take care of the cost of efficient production, plus a reasonable profit. In the writer's opinion this plan would result in confusion and dissatisfaction in the minds of the purchasing farmers, and might constitute a temptation to manipulate on the quarry operator's part.

The writer believes that it would be better, so far as possible, to meet the growing demand by increasing the percentage of directly pulverized stone and adjusting the price from time to time to a fair average between a reasonable price for screenings and a reasonable price for the direct product, selling both at the same price under the one general classification of "agricultural limestone."

Limestone More Than Mere Soil Acid Neutralizer

In the past, principal emphasis has been placed upon the acid neutralizing ability of limestone. Recent investigations, however, are causing some research scientists to feel that perhaps the chief value is to be found in the supplying of necessary plant food and that the alkaline, versus acid condition of the soil, is therefore, not so much an ultimate consideration as it is a symptom or indication of the presence or absence, respectively, of a sufficient supply of calcium and magnesium. If the latter theory is true, the future may show some tendency to premiumize the calcium content as compared with the magnesium content in the various limestones used. Calcium seems to be required in much heavier quantities than magnesium by the standard farm crops. Both carbonates are useful in neutralizing soil acids. Pound for pound magnesium is the stronger but it is also somewhat slower, or less soluble in the carbonate form. For the latter reason, in order to be equally responsive in the soil, it seems to be necessary to pulverize to a somewhat finer state the magnesium or dolomitic stones than is necessary in the case of the high calcium stones.

The Problem of Seasonal Demand

The demand for agricultural limestone is largely concentrated in the late summer and early fall. With the price as low as it is, it is important to eliminate or avoid every unnecessary item of expense in production, rehandling and distribution. The excess production in the dull demand period necessitates more or less open air storages at the quarries. As a means of minimizing this dead expense, the practice has been growing in favor of establishing a seasonal differential; i.e., a "bargain counter" or cut price in the off demand season, and a corresponding premium in the period of concentrated demand; holding the average at a fair level.

No way, as yet, seems to have been found for making extensive winter shipments. Under present methods the danger of having a shipment become wet and then freeze in transit is too great. If, in the future, a way can be found for storing the material in a dry condition under protection from the weather and later loading it out in closed cars, all without adding too greatly to the cost, it may be possible to develop a reasonably large volume of business in the winter months.

In past years, plant managers, superintendents and foremen have been accustomed to looking upon "screenings" as a waste product not worthy of protection or consideration. Today, with a much more satisfactory price than in the past, and with agricultural limestone assuming a much more important place in the quarryman's sales work, attention may be profitably directed to more care at the production end in the matter of protections of screens, spouts, bins and open ground storage so as to prevent adulteration and degredation from admixture with coarser sizes or foreign material. Care also should be exercised to see that empty railroad equipment is reasonably clean before it is loaded and that the ground upon which surplus production may be temporarily stored in the off season is level, clean and well drained.

Justification for Low Freight Rates

Fortunately the "higher up" railroad officials have been sold, not on the low grade character of limestone as a justification for low freight rates, but upon the importance to the railroads from an enlightened selfish standpoint of promoting and encouraging soil building and soil maintaining practices in the territory which their lines serve and which in turn serves their lines. As a result, agricultural limestone in Illinois is enjoying and should continue to enjoy remarkably low freight rates. Efforts to disturb the existing rates or to fight freight rate cases before the commissions, based upon consideration of the direct revenue to the railroads, should be discouraged in favor of the broader arguments just cited.

Before concluding this article, it is perhaps desirable to say a few words about the farmer's financial state of mind and the outlook in the grain states of the mid-West, with reference to the probable demand in 1926, for crude (or so-called raw) soil building materials. While undoubtedly the grain farmer is in a very much better condition today than he was three or four years ago, he is far from being satisfied in his own mind that the situation has been permanently righted and is seriously dissatisfied with the failure of the country thus far to produce sound solutions, legislative and economic, for the problem of the low priced exportable surplus which depresses the domestic price and places agriculture at a disadvantage with other industries on the American standards of values and living.

The Farmer's Problem

This state of unrest has bearings both pro and con on the farmer's attitude toward the project of soil building. His first reaction is that he cannot afford to invest in soil building commodities and that to the extent they increase his production they increase his most troublesome problem. With the better thinkers, however, there is a second reaction, which is, that grain productive acreage should be reduced, thus cutting down labor and operating costs and lessening the damage wrought by surplus production, while, at the same time, increasing the production and the efficiency per acre of the land in grain, thereby reducing the cost per bushel. This means greatly increased acreage in legumes, such as sweet clover, alfalfa, cow peas and soy beans. The legumes, in turn, are heavy feeders on raw minerals, particularly calcium and phosphorus. Their successful cultivation makes an abundance of these elements an essential requirement. The program, therefore, of limestone, phosphate and legumes is growing rapidly in favor with the grain farmers, for it is not only a prominent factor in the solution of his difficulties but is also a constructive program in soil building.

Agricultural Limestone and Phosphate Practice Elsewhere

We have already described the limestone practice in Illinois, which is, the use of fairly coarse and inexpensive material in large quantities. Along the phosphate line, Illinois has always been the leading proponent of the use of phosphorus in the form of finely ground, crude rock phosphate, used in relatively liberal quantity per acre. During the intervening years since 1920, the use of ground rock phosphate experienced a serious slump which nearly put the producing industry in Tennessee out of business. This slump was not due to disappointments in results but, rather, to the farmer's financial condition and the comparatively heavy expense of purchasing and applying rock phosphate. The year 1925, however, saw a very material revival in the tonnage of ground rock phosphate, and the prospect for 1926 seems to be one of continued improvement.

The states east of Illinois lean toward the use of more finely pulverized limestone and to phosphorus in the form of acid phosphate. Indiana's predominating limestone policy is for material "8 mesh or finer." Ohio is a strong proponent of finely ground material even at materially higher costs. The states west of the Mississippi river may be said to be more nearly virgin in the condition of their soil, and the soil building project and has not, as yet, assumed prominent proportion in any of them, although Iowa seems to be awake to the wisdom of the "stitch in time" policy and already has its limestone program under way. It seems probable that it will follow much the same practice as Illinois has followed in the type of material used. There seems also to be quite a growing interest in Iowa in crude ground rosk phosphate.

In conclusion, the writer feels that there is no problem before the nation more important than that of maintenance of soil fertility and that the government and the public alike should join with the farmer in an effort to place agriculture on a basis where it can and will afford to adopt a policy of permanent soil fertility. Certainly it is in the interest of producers of the crude materials involved, such as limestone and rock phosphate, to actively endorse and promote every sound step in this direction.

Agricultural Limestone Producers Have a Very Good Year

THE producers of agricultural limestone have had an excellent year. Practically every producer reported an increased output, the increases running from 12 to 100%. Prices tended to be lower, the average showing the price to be 1% less, although there were some producers who reported increases of price of as much as 12%.

The future looks very rosy for all producers said that they expected to produce more in 1926 than in 1925. Some of these fixed very high figures for their expectations—100%, 150%, and even 300%. But in the main the expected production for 1926 was estimated to be in the neighborhood of 50% more than in 1925. Significant of this tendency is the decisoin of the Marble Cliff Quarries Co., Columbus, Ohio, to rebuild their agricultural limestone plant destroyed by fire about four years ago.

The cause of this increased production and rosy outlook is mainly the increased prosperity of the farmers, although a good bit of it must be laid to the campaign of education that has enlisted the services of so many organizations, farm bureaus, farmers' institutes, and the limestone associations. It is no longer a new or an unusual thing to spend money on agricultural limestone, and as Mr. Bent points out in the article accompanying this, the same inertia which has kept farmers from buying limestone in former years will keep him buying limestone, once he has started.

In addition to filling out the questionnaires which were sent out by Rock Products, a number of producers gave their comments on the agricultural limestone situation as they see it. These are so enlightening that a few of them have been selected as typical to show how producers feel as to the past and the coming year.

* * *

"We are selling all the screenings that we make and other operators report heavy sales. If the farmers have the success that early experiments indicate as a result of using limestone we should get a hard roads legislature in 1926."

* * *

"Farmers are more prosperous than for many years. They are in better spirits

and feel like investing in agricultural limestone. The demand in 1925 far exceeded our capacity."

* * *

"We do not expect any boom; only normal conditions."

* * *

"We find the demand for our type of product (agricultural limestone) is in its infancy and the next few years will show a rapid growth and the saturation point will not be reached for years to come."

* * *

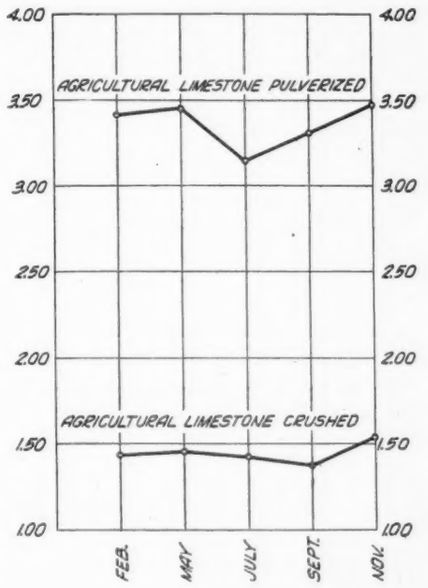
"Farmers are increasing their use of agstone, although the demand is seasonable. We can sell more than we can make."

* * *

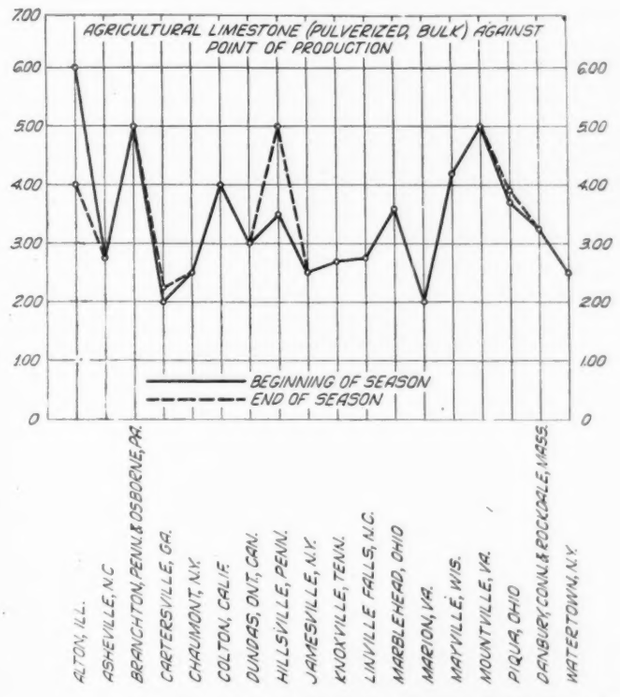
Limestone and Gypsum Increasing Farm Yields

FARMERS, however slow they may have been to adopt the use of limestone and gypsum on their acreage, are now getting to the point where they consider these as essential items for the successful and best returns both from a quantity and quality standpoint. Various farm bureaus working in co-ordination with the gypsum and limestone producers have finally convinced the greater majority of the farmers of the advantage that lies in the use of these fertilizers.

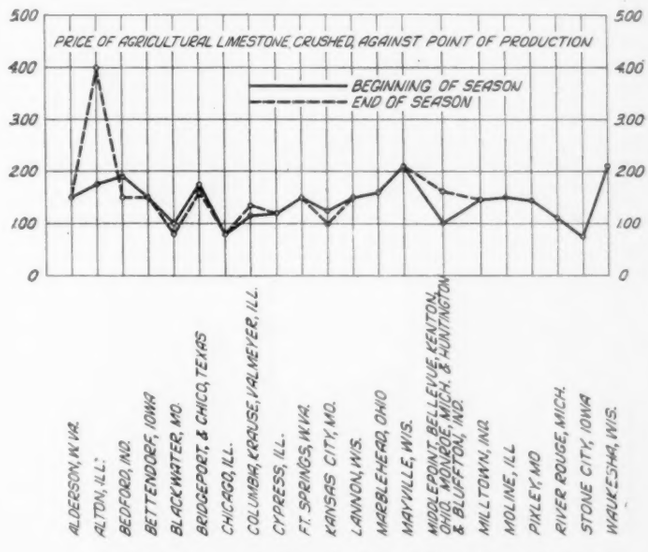
The farmers, quick to take advantage of co-operative buying, have made their purchases in carload lots, usually to be delivered to the county center, where it is broken up into the amounts purchased by the individuals. This has given them a considerably lower price for these items because of lower freight rates and quantity prices that the producer has given them.



Seasonal variation in agricultural limestone prices in 1925—Note the upward tendency at the close of the year—rather unusual



Prices of agricultural limestone (pulverized) plotted against point of production



Prices of crushed agricultural limestone plotted against point of production

Still greater activities for the further continued use of these fertilizers have been made by many of the railroads, which have run special experimental and testing trains, equipped with soil-testing apparatus and manned by experts. These trains have given advice to the farmer on the kind of crops to grow and the proper fertilizer to use on the individual soil. Consequently it is not surprising to read of the increased orders for agricultural limestone and gypsum.

Idaho Publicity for Its Non-Metallic Minerals

RECOMMENDATIONS that the Idaho Chamber of Commerce be organized at once by election of officers and directors; that annual meetings be held, to be known as the All-Idaho Congress; and that a program of publicity and advertising designed to put Idaho and its opportunities before the people of the United States be undertaken at once, were presented and adopted recently at the first All-Idaho Congress, sponsored by commercial organizations of the state, meeting in the house chamber of the capital.

The organization will raise and use $50,000 in the first year of its publicity work to attract new enterprises to exploit the resources of the state.

An excellent summary of the state's non-metallic mineral deposits was made by former State Senator Ravenal Macbeth, who is secretary of the Idaho Mining Association. He said, in part, Idaho has hundred of millions of tons of the highest grade phosphate rock to be found in the world.

In one of the counties there are some of the finest beds of slates, rivalling those of Pennsylvania, which is the only other state where they may be found. In many other localities in the state are large deposits of gypsum, dolomite, high calcium limestone, bentonite, barytes and clays. There are also beds of tripolite of a very high silica content, large deposits of asbestos and the only other deposit in the United States of 'black marble,' the other being in Vermont.

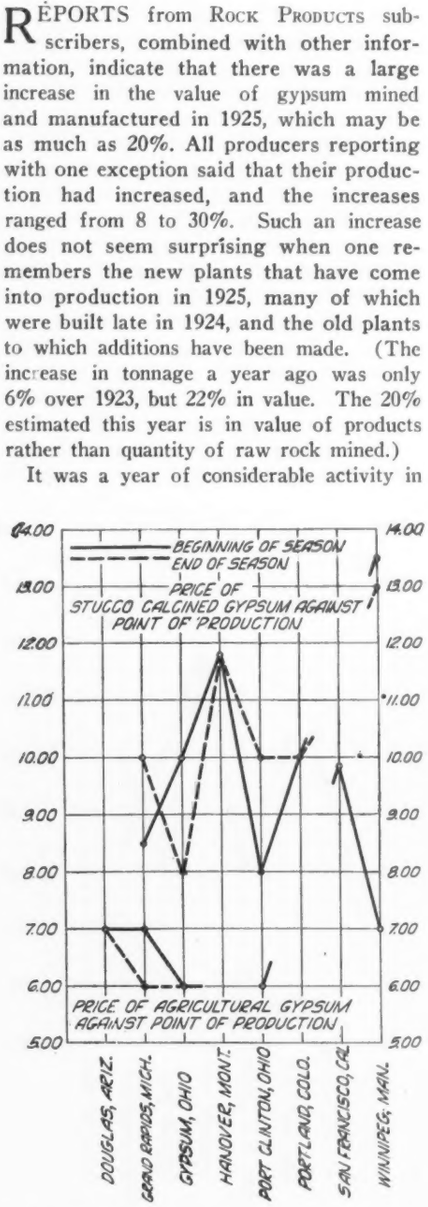
"While a few men in Idaho are aware of the great variety of our deposits of non-metallics, the people of the state and country at large have not this information. It is through a 'director of publicity' or some official of the state that this information should be disseminated."—*Boise (Idaho) News.*

Review of Gypsum Industry in 1925

About a 20 Per Cent Increase in Value of Gypsum and Gypsum Products Over 1924—Progress in Wallboard, Sheathing and Blocks

REPORTS from ROCK PRODUCTS subscribers, combined with other information, indicate that there was a large increase in the value of gypsum mined and manufactured in 1925, which may be as much as 20%. All producers reporting with one exception said that their production had increased, and the increases ranged from 8 to 30%. Such an increase does not seem surprising when one remembers the new plants that have come into production in 1925, many of which were built late in 1924, and the old plants to which additions have been made. (The increase in tonnage a year ago was only 6% over 1923, but 22% in value. The 20% estimated this year is in value of products rather than quantity of raw rock mined.)

It was a year of considerable activity in



Prices of calcined gypsum or stucco (above), and prices of agricultural gypsum plotted against point of production at beginning and end of the season

gypsum developments. Our records show 10 new incorporations with a total capital of $15,000,000. The rise in the price of United States Gypsum Co. stock on the Chicago Stock Market and the New York Curb Market have been notable even amid great activity in all industrials.

The same producers with very few exceptions reported a lowering of prices, so it is judged that the same causes are operating in the gypsum industry as in other rock products industries and that these produce the same results, which are a general lowering of prices combined with increased production and a lowering of the costs of production. The average price reduction was 3½%.

Pertinent Comments by Producers

"Pacific coast plaster production will show an increase in 1926 over 1924."

* * *

"Our increase was very large in 1925. I believe New York state has about reached its peak in building, at least for a while. Also gypsum plants in New York are more than able to take care of the needs."

* * *

"Our three plaster factories (west coast) have a total capacity of 20,000 tons of plaster a month, and should run in 1926 to at least 75% capacity. We will probably have price-cutting competition. Business keeps good this winter."

* * *

"Indications coming to us are that the agricultural sections of all northwestern states are all going to be prosperous, and the basic industries of the Pacific coast are preparing for maximum outputs to handle expected demands."

* * *

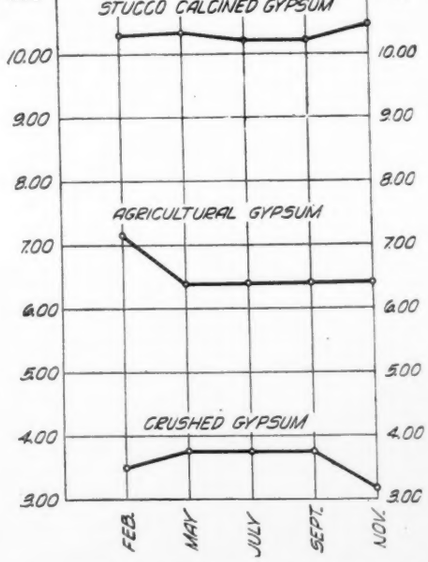
"Building situation is so unsettled that it is hard to anticipate the outcome of 1926 (New Jersey)."

* * *

"The present activity in steel, coke and coal indicates to us that 1926 will be as good or better a year than 1925 for building construction (Ohio)."

* * *

Reviewing the progress of the industry one notes especially the increase in the manufacture and use of gypsum products. There has been a very large increase in the production of wall board, for example. Gypsum sheathing, to take the place of rough board sheathing in frame houses has been tried and found a success in every way. It is actually stronger than the lumber product it displaced and in addition it has better insulating qualities and is fireproof. Structolite (gypsum concrete) was introduced in 1924, but its progress has been made in 1925. Gypsum stucco, which is not only weatherproof, but which will adhere to other materials such as concrete, is reported to be in successful use in Great Britain, and another gypsum stucco is reported from the Pacific Coast. Whether these are pure gypsum products or compounds is not stated. A brand of stucco which has been marketed by a large gypsum producer is stated to be mainly composed of hydraulic lime. Gypsum compounds seem to be increasing in importance. A new flooring



Seasonal fluctuations in prices of calcined gypsum, agricultural gypsum and crushed gypsum

of German origin, but which it is said will also be manufactured in this country, is a lime-gypsum compound with diatomaceous earth and fillers. This is intended to take the place of the more expensive *estrichgyps*.

The extent to which gypsum products have progressed may be appreciated when it is known that it is possible to build good sized structures entirely of gypsum products, walls, roofs and floors, the stucco on the outside and the paint on the inside, and to use only those products which are now on the market.

A notable feature in this year's progress has been the appearance on the market of products made of so-called "synthetic" gypsum. This is a waste product from the manufacture of phosphoric acid and for a long time it could not be utilized because it was not sufficiently cleaned and, it is said, because the crystallization was not of the character to make a strong plaster. Special methods of handling and of centrifuging have overcome

these difficulties and about 20 tons per day are now being made into blocks and marketed under the trade name of "Fabricast." Rattan fibre is said to be used as filler. Patents on the process are held by the company, but licenses have been granted to another company which has built a factory and will soon start producing blocks from the 30 tons of gypsum which has hitherto been wasted daily.

Such small production would be of no significance if it were not for the possibility of a considerable increase. The manufacture of phosphoric acid for fertilizing purposes is coming to be conducted on new lines and higher concentrations of phosphoric acid are already on the market. In the manufacture of these gypsum is a by-product, and if all this gypsum can be utilized in the manufacture of block, wall board and similar products, there is bound to be a considerable effect on local markets.

The technical advance in calcining and other processes by which gypsum is prepared for the market appears to have been largely of an experimental nature. Much of it has been recorded in Rock Products. Studies by the Bureau of Standards and by other research bodies appear to be directed to two objectives, the waterproofing of gypsum or the making of waterproof compounds largely composed of gypsum, and the finding of a use for anhydrite. Waterproofing by an exterior treatment was pretty thoroughly studied at the Bureau of Standards. The best results were obtained by hot applications of a barium chloride solution which formed a protective coating (presumably by filling the pores with the insoluble barium sulphate) that stood exposure to the weather for two years. It is supposed that repeating the treatment would enable it to stand for another two years. (Rock Products, October 31.)

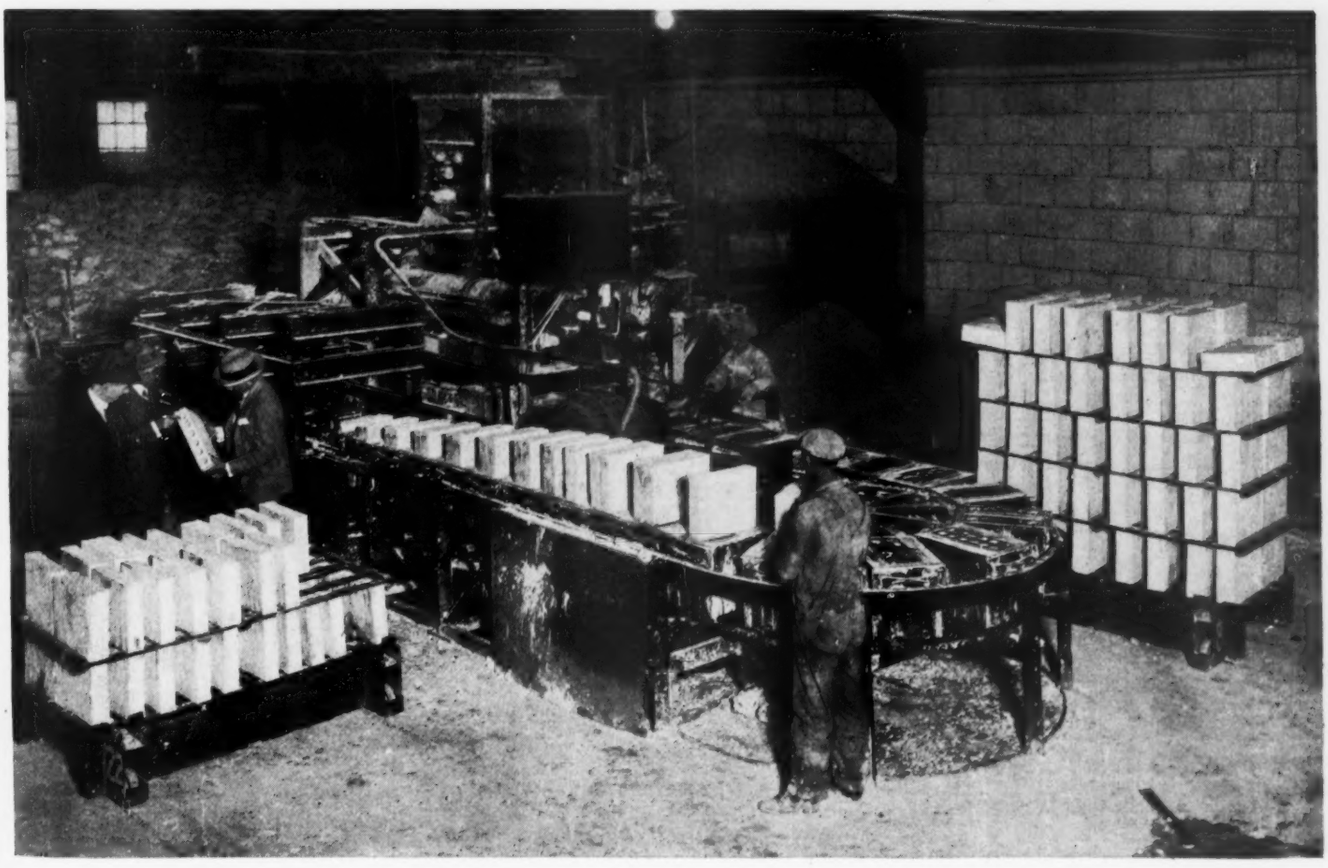
The making of waterproof compounds or gypsum which is calcined and treated in such a way as to be waterproof seems to be in the experimental stage with prospects of success. This is judged by samples sent from abroad to Rock Products and others noted on editorial trips. The samples received were soaked in water for weeks and they did not disintegrate. One had the appearance of marble, although it was not so hard. The methods by which these were made were not divulged, but they were said to be of pure gypsum calcined and recrystallized in some special way.

Studies of anhydrite were made to see if it could be used as a retarder for portland cement. It was found that mixtures of gypsum and anhydrite might be used, although gypsum is more efficient. (Rock Products, October 31.)

Two important studies of anhydrite were made, one in Russia by Budnikov and Levin, the other at the New Brunswick, N. J., station of the U. S. Bureau of Mines by Miss Marie Farnsworth. Rock Products, November 14.) The Russian experimenters tried catalysts with natural anhydrite and dead burned gypsum. The natural product gave no encouraging results because it lacked the property of setting, but with dead burned gypsum very strong plasters (or cements) were obtained. The best results came from the use of 1% of sodium acid sulphate ($NaHSO_4$).

Miss Farnsworth tried physical methods. Knowing that natural anhydrite tended to form gypsum, she tried to hasten the process by fine grinding of the anhydrite. It was found that on an experimental scale at least anhydrite could be converted to gypsum by fine grinding and then standing in contact with water for varying periods of time, according to the material and the fineness to which it was ground. It appears that the time required is not unreasonable and there are commercial possibilities in the method.

In the Eastern states probably the most startling announcement was that of the discovery of a large body of gypsum rock near Clarence, N. Y. This is northwest of the Akron and Oakfield deposits. Geologists had expected that a continuation of these deposits would be found to the northeast, but only anhydrite was found in that direction. The discovery was made in June, but was kept secret until a com-



New gypsum block machine of the Blue Diamond Co., Los Angeles, Calif.—one of the developments of 1925

pany was formed to work it, known as the National Gypsum Co. It will manufacture wallboard from all the gypsum mined and expects to produce about 45,000,000 ft. per year.

Development of the gypsum industry has been very marked on the Pacific Coast. The Pacific Portland Cement Co. put its new plaster mill at Plaster City in the Imperial Valley in southern California early in the year, and the Blue Diamond Co. of Los Angeles opened a large deposit of gypsum in Nevada from which it is now drawing its supplies. The purchase of this deposit was preceded by one of the most exhaustive studies ever made on the gypsum resources of a region. Samples from various deposits were not only analyzed and tested in the laboratory, but the most promising ones were brought in by carloads and made into plaster. There has been a large increase in the manufacture of wall board and plaster board in all the principal cities of the West coast. A new kind of plaster board called "Fiberform" is being manufactured in San Francisco. It is made without paper either for backing or covering.

Of novelties in block machines, perhaps the most striking is the machine recently adopted by the Blue Diamond Co. of Los Angeles, Calif. It makes a cored block, but the core holes do not go all the way through. The advantages are said to be that a circulation of air is prevented and also that the block lays more easily.

This form of block demands a different method of removal from the molds than is usually found in block machines. Instead of the cores being drawn, the block is pushed off the cores. The cores are made of glass and are slightly conical to facilitate this method of removal.

Typical of the continued progress in the manufacture of gypsum wallboard and sheathing are the two new plants of the Universal Gypsum Co.—one in New York and the other in Texas—which are described in the succeeding columns of this review.

Universal Gypsum Co.'s New Wallboard Plants

In August of this year the Universal Gypsum Co. placed in successful operation two large modern wallboard plants for the manufacture of "Gypsolite" wallboard, one at Akron, New York, and the other at Rotan, Texas. With the addition of the wallboard plants these two mills are complete in the manufacture of gypsum products.

In the cycle of operations at the Akron mill the mined rock is brought by a Goodman electric locomotive, 7½-ton capacity, to a Jeffrey rigid hammer crusher, installed in the mine. This crusher has a capacity of 150 tons per hour. From the crusher the material is carried on an apron conveyor, to a continuous bucket elevator, extending from mine level to a point above the surface. It is then deposited in a hopper which feeds another continuous bucket elevator which elevates the material to a bin building over the feed end of the rotary calciners. At this point the crushed rock is screened. One screened product passes on belt conveyors to a loading bridge for "loading out" gypsum rock. The scale track is below this loading point. The other products either pass to the bins or to outside storage. The rock for stucco is deposited in the bins, and is fed to the rotary calciners. These are fired with pulverized fuel, the coal being pulverized in a Kennedy-Van Saun 8x5-ft. air-swept mill; all pulverized fuel for the calciners and the new boiler house for the board mill is pulverized by this. The coal is transported by air from this point to a 30-ton bin above the boilers in the boiler house 400 ft. distant. The entire pulverized fuel system was designed by the company's own engineers. The primary and secondary grinding of the gypsum is accomplished in a modern mill building and the material is elevated to overhead bins, from which the stucco is conveyed to the mixers and sackers and to the board plant.

From the stucco storage bins in the mixer building the material for the board plant is carried by screw conveyors over a bridge to a 300-ton steel bin in the board plant. The material is moved from the stucco bin to an elevator by drag chain. The elevator lifts the material to a small feed bin integral with the drag chain housing that feeds the "California" type of continuous mixer.

Gypsolite wallboard is made of gypsum without sawdust such as some gypsum boards must employ to obtain reasonable lightness. By special process, fully covered by patents, the gypsolite core is "grained" with small dead air cells, each surrounded by strong, tough gypsum walls. It is from this special process that gypsolite wallboard inherits its extra strength and lightness, its toughness under sawing and nailing and its remarkable insulating qualities.

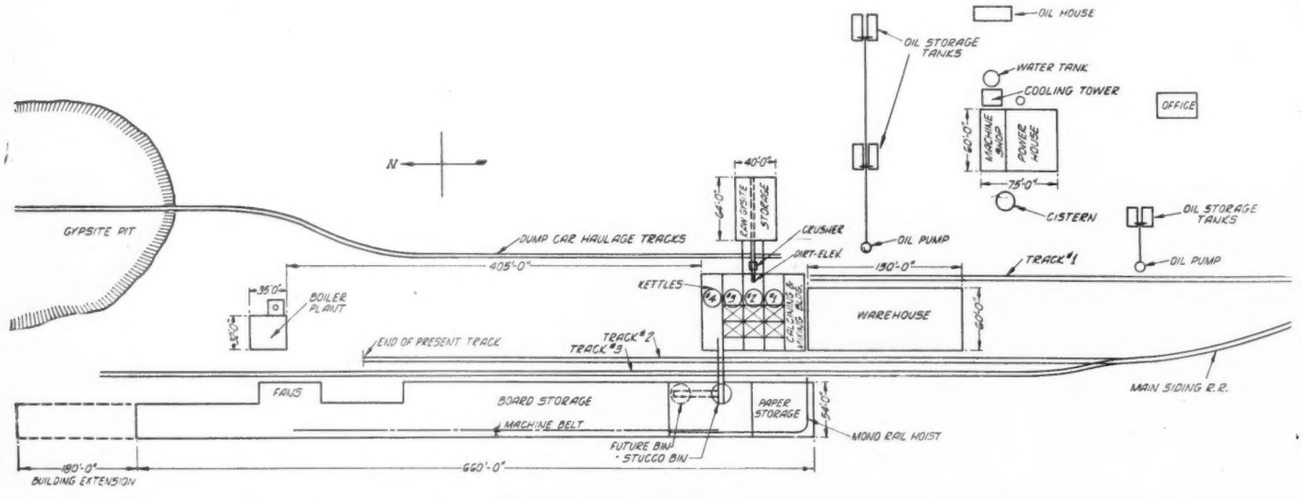
The paper rolls for the wallboard are unloaded from cars and carried by a Euclid 3000-lb. monorail hoist to the paper storage section. This same hoist is used for carrying the paper from storage to points on the board machine where it is used. From the squeeze rolls and cleaning rolls the "green" board is carried on a 54-in. continuous rubber belt conveyor, 500 ft. long, divided into three sections, supported on ball bearing rollers to a Knowlton cutter.

The entire board machine is driven by a countershaft extending full length of the machine, under the belt, supported on the steel frame. The head pulleys of each belt section is driven by worm gears and pinions from this main shaft.

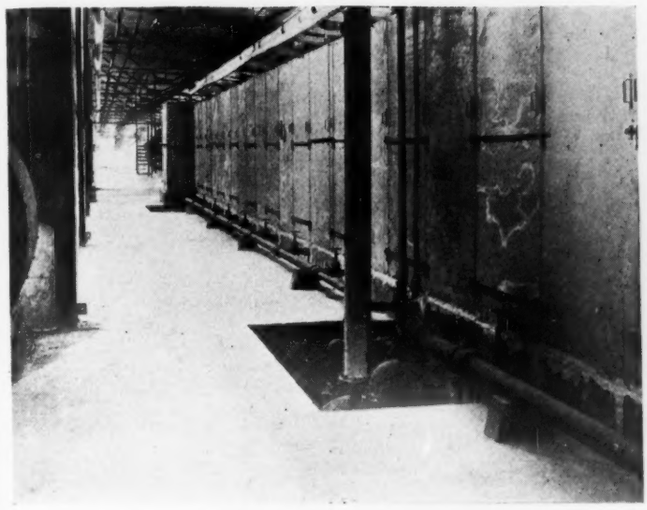
The top of the board on the machine is 52½ in. above the floor; with the machine constructed at this elevation, the entire apparatus is easily and readily accessible to the operators through wide aisleways.

The operation of the main units of the board machine and its accessories is controlled by one operator; that is, this operator can start or stop these units from his station at the squeeze rolls, push buttons operating the remote control of the automatic compensators for the motors driving of these units.

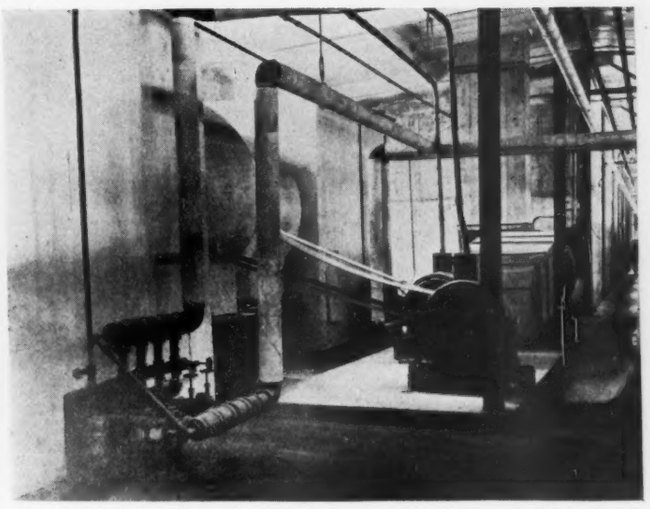
From the cutter the boards are carried



Plan of the new wallboard plant of the Universal Gypsum Co. at Rotan, Texas



Wallboard dryer installation at Akron, N. Y.



Heater fans for wallboard dryer at Akron, N. Y.

over a series of rollers to an automatic power driven cross transfer and feeding tipple furnished by the Coe Manufacturing Co. One operator works both devices, which feeds the boards continuously from the board belt into the dryer without handling.

The transfer is a combination of belts and rollers on a steel frame 12 ft. 6 in. by 21 ft. The lateral or cross-wise movement of the boards is accomplished by the operator raising and lowering the belts. When two boards are dropped onto the moving rollers in line with the dryer they are immediately run off two abreast on to the tipple.

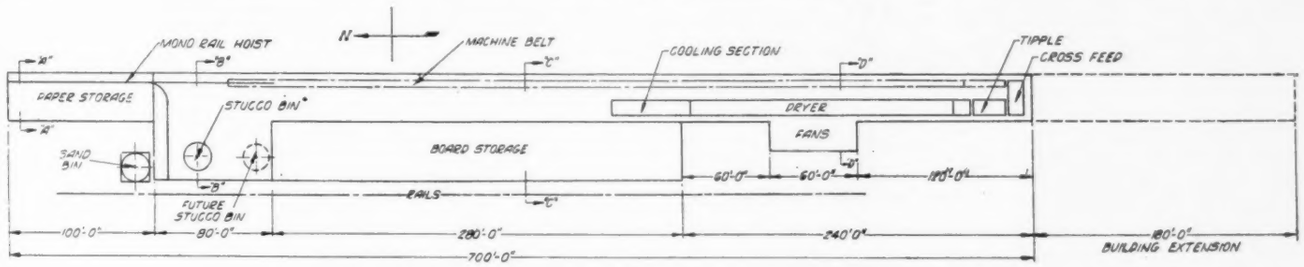
The tipple is 24 ft. long, and provided with rollers and belts driven at a speed of about 100 ft. per minute. The tipple is pivoted on a shaft at the receiving end and under control of the operator so that he can run the boards onto any one of the six dryer decks. The dryer is provided with an automatic feed end of sufficient length to handle 12 ft. boards, and is thereby kept at least 95% full continuously.

The dryer was also furnished by the Coe Mannufacturing Co. and is their latest design, six decks high, with 9-ft. rollers for handling either two 48 in. or three 32 in. boards (in width) per deck. The enclosed drying space is 180 ft. long, with an average capacity of 150,000 sq. ft. per day. The overall dimensions of the dryer, including feed end, cooling and unloading sections, are 273 ft. long, 10 ft. 6 in. wide and 8 ft. high above foundations. The feeder and transfer requires an additional 37 ft. length, making an overall dimension of 310 ft. A 7½ hp. motor is required to drive the entire dryer; the motor drives through a Reeves variable transmission to the driving rig.

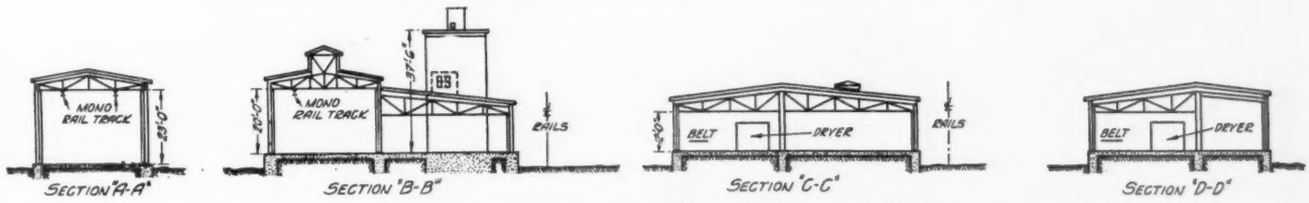
The air system consists of two large Sturtevant multivane supply fans, each provided with reheater coils; also one exhaust fan, all located in a fan room adjoining the middle of the dryer room. One feature of this design is that all supply and return air ducts connecting the fans to the dryer are built of concrete underground, so there is no obstruction to the passage way between, and the dryer is readily accessible from all sides, as is clearly shown in an illustration.

The supply fans discharge hot air at about 275 deg. F. into two underground ducts connecting with the dryer manifolds provided with nozzles which gives a positive and even distribution of air between the decks. The air then passes over the boards towards each end of the dryer, and is constantly picking up moisture, but the temperature is maintained at the proper point by steam coils in the dryer beneath each deck. At the ends of the dryer the air passes through ducts or manifolds into a large return air duct made a part of the foundation under the dryer.

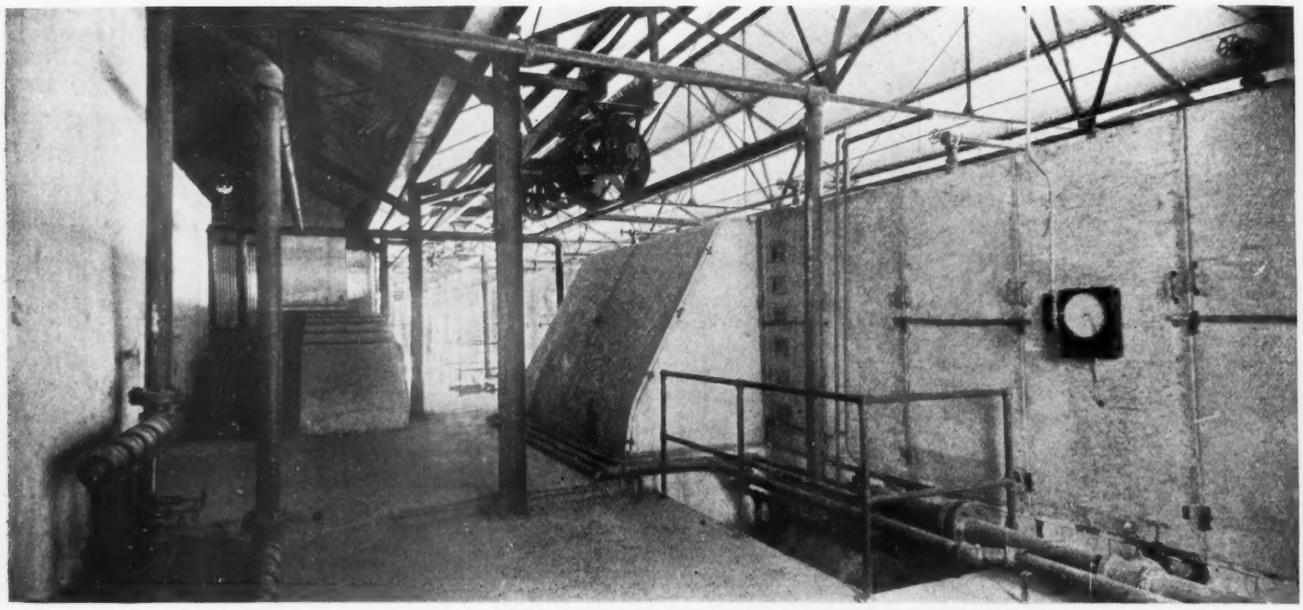
Approximately 85% of this air is recirculated through this duct and connections to the intake boxes in front of the reheaters. There if is mixed with a small amount of fresh air, passes through the reheaters to the supply fans and is used over again. The exhaust fan is also connected with the return air duct system, and continually exhausts a volume of air equivalent to the make-up air supplied, which prevents the air in the dryer from becoming saturated.



Plan of the new wallboard plant of the Universal Gypsum Co. at Akron, N. Y.



Typical cross-sections of new wallboard plant at Akron, N. Y.



Dryer installation at the Rotan wallboard plant of the Universal Gypsum Co.

A system of dampers is provided to control the recirculation and humidity and to prevent leakage from the ends of the dryer.

The steam circulation system is of a new design by the Coe Manufacturing Co., using only three tanks and three traps for the entire dryer. Valves are installed on each 6 ft. dryer section, so the steam to the coils can be controlled and the temperature regulated. The steam is circulated in stages at high velocities, the condensate going to the large tanks, and the hot water is then put through several condenser sections and a condenser tank and then to the boiler.

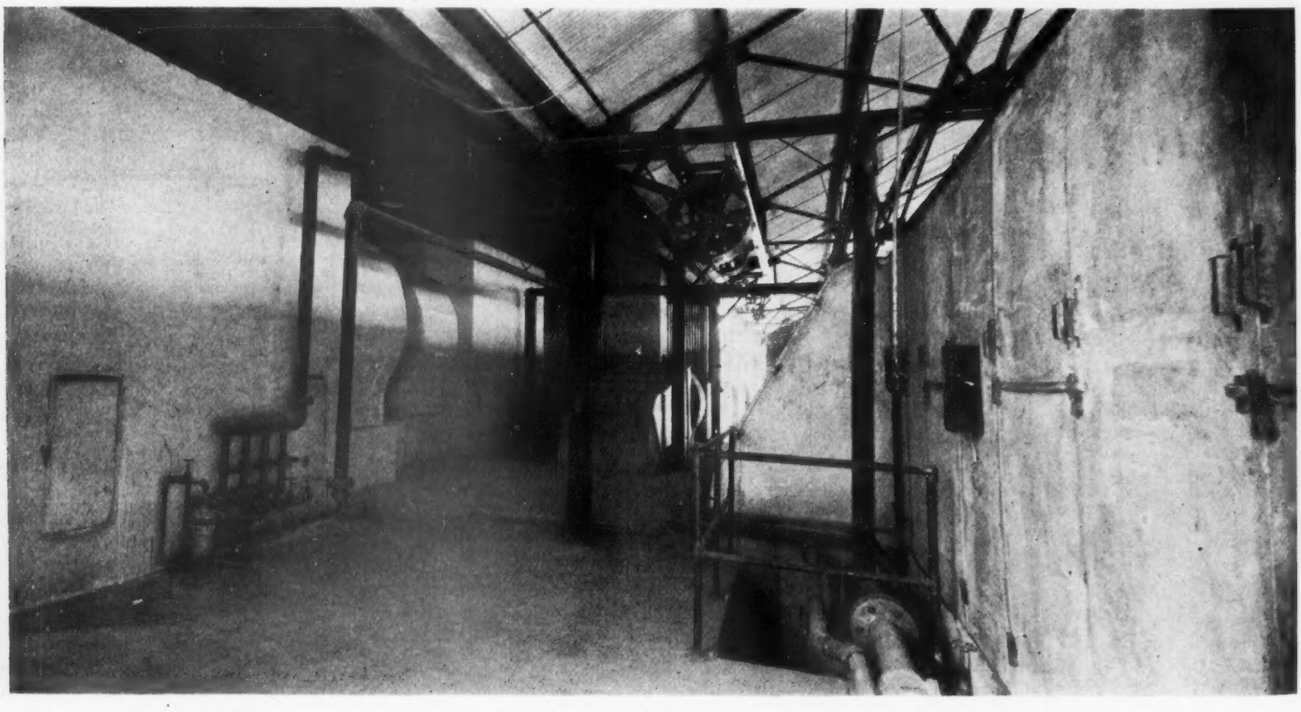
The dryer is well insulated, a 6-in. slab of Insulex having been added to the top. This was found to increase the dryer temperature 10 deg. and very materially cut down the heat loss due to radiation.

Insulex is a new product of the Universal Gypsum Co. and is manufactured at all the plants. Insulex is puffed gypsum; a "chemical yeast" is added to the stucco so that when the powder is mixed with water a gas is formed which expands the mixture several times its original volume. This action forms confined dead air spaces by the millions, honeycombing the entire mass, which being composed of gypsum, a material itself of low conductivity, forms an insulating material of excellent efficiency. It has been estimated that the addition of this insulation to the dryer has effected a saving of 10 hp. at the boiler.

Insulex is made in various grades for various purposes. With its inherent properties of heat and cold insulation and sound deadening, a wide field for its use has been found in the rock products industries.

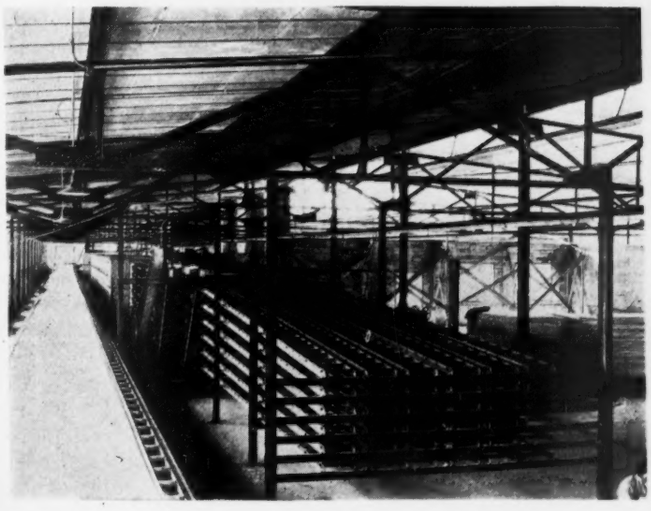
The dryer doors are made with a steel frame, insulation being 2 in. thick, and an improved tight latch bar instead of the old wood frame construction.

The roller shafts revolve in ball bearings, driven by sprockets and chains from a drive



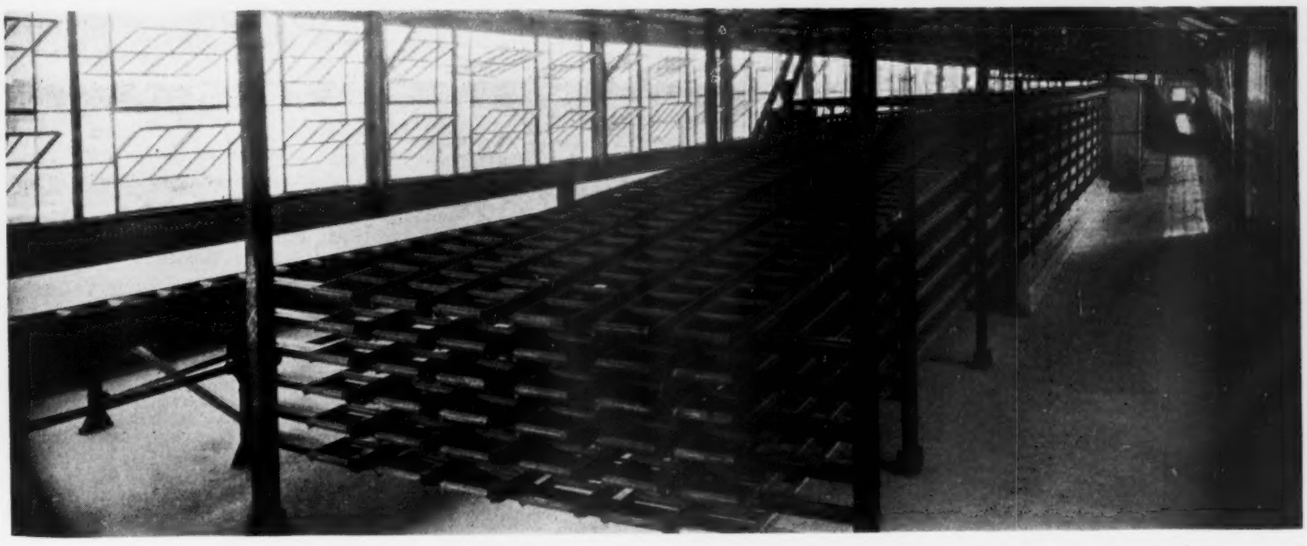
Another view of the dryer at the Rotan wallboard plant of the Universal Gypsum Co.

General view of the wallboard machine (right), the cross feed table to the dryer, and the feed end of the dryer (left)



Take-off end of wallboard dryer and part of the board storage

Close-up of the cross-feed tables from machine to dryer



General view of the take-off end of the wallboard dryer at the Rotan, Texas, plant of the Universal Gypsum Co.

rig at the dry end of the dryer. This drive rig is driven by a motor through a Reeves variable speed transmission, so that the speed of the board, or drying time through the kiln, may be varied and accurately controlled. It has been demonstrated that the board itself, the kiln temperatures, the drying time, etc., must be held within close limits to obtain a high quality product.

The cooling section at the dry end is merely an extension of the dryer, without heat or enclosure, and is 54 ft. long, which gives sufficient time for the boards to cool down to the room temperature before piling. This prevents sweating and has an important bearing on quality. A 27 ft. sloping take-off made of gravity ball bearing rollers on a structural frame has been added at the end of the cooling section, so the boards may be more readily unloaded, more easily handled, inspected and placed on palettes.

The loaded palettes are moved to the board storage section by lift trucks. These same trucks are used in "loading out" the board to the cars. The floor level of the cars and level of the board storage floors are the same.

The board plant building is 700 ft. long and 74 ft. wide at the widest section, which is through the board machine section and board storage section. Steel construction was used throughout for the framing. The building was erected by the Lackawanna Steel Construction Co., who also furnished all the steel structure for the board machine and platforms. A unique feature in the construction of the exterior wall is the use of poured-in-place gypsum walls. The gypsum monolithic roof was constructed by the Lathrop-Hoge Co. Truscon steel sash and doors were used throughout; excellent lighting and ventilation is obtained with this layout of steel sash.

The steam, hot and cold water lines from the boiler house to the board plant are carried through a tunnel connecting these two buildings.

As previously stated, pulverized fuel is transported by air from the pulverizers to a 30-ton overhead bin. The boiler is a 300 hp. Sterling water tube, with a specially designed combustion chamber for burning the pulverized fuel. Utilizing pulverized fuel precluded expensive methods of handling and storing coal and disposition of ashes, as well as providing a more flexible means of firing the boiler for various ratings, also allowing use of a lower grade of coal. The feed water for the boiler is obtained from Ledge creek on the company's property. A Reilly evaporator, furnished by the Griscom-Russel Co., is utilized when other water than that from Ledge creek is used for the boiler. An Ingersoll-Rand air compressor with its accessories is also located in the boiler house, this compressor having sufficient capacity to take care of the needs for compressed air of the entire plant.

The type of construction for the boiler house is the same as of the board plant, steel framing with gypsum side walls and roof, steel sash and doors. A 48 in. by 80 ft. self-supporting steel stack, constructed by the Ferguson-Allan Co., is provided for the boiler.

The entire board plant is laid out with the intention of ultimately obtaining a daily production of 200,000 ft. of gypsolite board. All of the equipment is of the best and it can be stated that it is one of the most modern plants for the manufacture of wallboard in the industry.

As the board plant at Rotan was constructed at the same time as the one at Akron, the same general design was followed as far as the board machine and its equipment.

The building is of steel construction and has overall dimensions of 660x54 ft., with galvanized corrugated steel siding and roof. The entire wall area from a height of 4 ft. above the floor to the eaves along the board machine and dryer is steel sash, affording excellent lighting and ventilation.

As at Akron, all steam, hot and cold water lines are brought to the board plant from the boiler house through a tunnel. The fuel used for firing the Sterling boiler at Rotan is oil. The Ellis dryer system is used for feeding condensate returns to the boiler.

The present capacity of the board mill is 150,000 ft. of board, but as at Akron an ultimate capacity of 200,000 ft. can be obtained with additions.

The board machine for both Akron and Rotan was designed to manufacture 32 in. and 48 in. gypsolite board.

With the new board plants at Akron and Rotan and the other board plants at Fort Dodge, Iowa, and Batavia, N. Y., an average daily production of 450,000 ft. of gypsolite board is obtained.

Progress in Gypsum Products Research

THE American Society's for Testing Materials committee C-11 on gypsum products through the Bureau of Mines is still at work on investigations dealing with the possible use of gypsum-anhydrite mixtures in the manufacture of portland cement for the purpose of retarding the time of set.

Tentative specifications were prepared for molding and casting gypsum plasters, as well as dental, orthopedic and pottery plasters made from calcined gypsum.

The increasing demand for information regarding the use of reinforced gypsum for structural purposes, such as fireproof floors and roofs, has led to research work for developing the following:

Check test methods for field inspection use.

The determination of unit and ultimate working stresses for compositions consisting of gypsum and various percentages of aggregate.

The possible adoption of specifications and recommended practice regarding structural gypsum in many of its present accepted forms.

The development of specifications to govern the manner of selecting and preparing for use, test specimens obtained from the construction which are to be tested at the laboratory.

In the foregoing, assistance is being rendered by the testing laboratories of Columbia University and the U. S. Bureau of Standards.

The Bureau of Standards submitted to the committee for its information data regarding: The elasticity of gypsum plasters of various mixtures, the sand carrying capacity of gypsum plasters and the modulus of elasticity of gypsum and aggregates.

At the next meeting of the committee, which is likely to be held in March, 1926, at Washington, D. C., specifications for structural gypsum products will be prepared in tentative form.

Accident Prevention Methods*

THE issue for August is devoted entirely to the work on accident prevention carried on by various industries. C. B. Auel, president of the National Safety Council, lists the advantages of proper plant organization for the reduction of accidents. The industry must attack the problem from all sides and if possible take advantage of methods used in other industries of similar nature. Careful supervision under capable men, mechanical safeguards, regular departmental and plant meetings to discuss safety measures are certain to decrease the number of preventable accidents.

H. F. Webb, general safety director of the West Penn System is a firm believer in the safety education of the employes. This takes the form of safety literature, organized safety work, accident prevention contests and special educational campaigns. A novel idea is the safety dollar. Every employee receives one of these with his pay for 13 consecutive weeks and they are urged to save the complete set for the cash prize offered to those who hold lucky numbers. Then to stress the idea of safety there is the Loyal Order of Safety Boosters, the membership of which is limited to 1000 men, all pledged to carry on safety ideas.

D. Adam of the Safety and Welfare Dept. Lawrence Portland Cement Co., Siegfried, Penn., carries on a series of talks on safety. Every Thursday at noon, one man from each of the departments are gathered with him and a general discussion carried on for half an hour. He says that in such informal small gatherings he has obtained much valuable information and secured the personal relationship so necessary to carry on accident prevention work.

*Abstract from *Labor and Industry*, Vol. 12, No. 8, issued by Dept. of Labor and Industry, State of Pennsylvania.

The Sand-Lime Brick Industry

Steady Progress and Development Winning Ground at the Expense of Clay Brick in Spite of Propaganda

FEW rock products industries have shown a steadier and a more enduring growth than the manufacture of sand-lime brick. After passing through many hardships brought about by unscrupulous promoters and much experimenting by inexperienced people who did not learn how to make good brick, the industry has emerged on a sound and thoroughly established basis.

An interesting phase of the industry, aside from the increased production in this country has been the importation of sand-lime brick along the Atlantic seaboard from Germany—the original home of sand-lime brick. The industry in Germany has grown even faster than in this country and now one of the principal German manufacturers of sand-lime brick machinery has established an agency in this country to help promote the manufacture of sand-lime brick here. We give at some length farther on in this article a fairly complete description of the process and methods now used abroad in the most up-to-date plants as their introduction in this country may have some bearing on our own industry. We have also included in our review a description of one of the newest sand-lime brick plants in Michigan where the industry has its greatest concentration and where sand-lime brick are probably being used more extensively for industrial and general building than any other similar material.

Returns from ten representative producers scattered over the entire country show that the production of sand-lime brick in 1925 was 20% above 1924, which was 283,000,000. Our estimate of production in 1925 is therefore approximately 350,000,000—nearly a million brick a day. Prices averaged 2% lower, only one producer reporting an increase. This is a little less than the average reduction in the price of rock products building materials generally during 1925.

The outlook for 1926 is equally good. The average predicted increase in production is 29%, including two new plants which are just starting up. Discounting the effect of these plants the average predicted increase of the old plants is about 10%. We believe with the new plants now building and projected that another 20% increase in sand-lime brick manufacture in 1926 is not unlikely. Prices apparently will continue on about the same level as in the last year.

Producer's Comments

"I do not expect any greater building activity in 1926 than in 1925, and would not be much surprised if business fell off considerably. The only reason we feel that we can sell 40% more brick next year is because we are displacing other building materials. We expect competition to force prices down about 5% (Michigan)."

* * *

"The industrial outlook is much better in this locality (Michigan)."

A Review of Sand-Lime Brick Development

Sand-lime bricks are not a new product, although not used much until lately. It is known that they were used in the buildings in Solomon's time. Some of these same brick are in the British Museum in London. For centuries the sand-lime brick industry was small and did not grow until toward the end of the 19th century. In 1880 a German, Dr. William Michaelis, patented the process for making sand-lime brick and a few years later the patent lapsed and much was done in starting this new industry in Germany, where practically all the development was made until shortly after 1900.

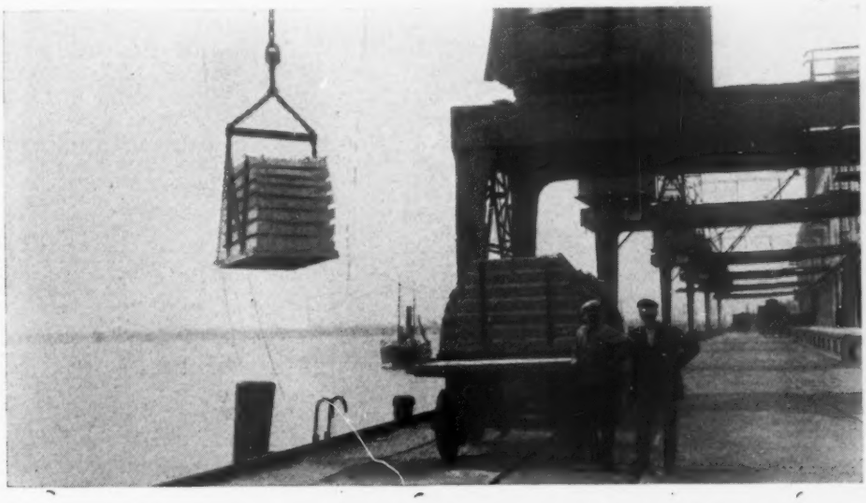
In 1901 the first sand-lime brick plant in the United States was started at Michigan City, Ind. A short time later a brick plant was started in Saginaw, Mich., and having the right kind of equipment and management this plant is still in operation today and still under the same management. So the plant of the Saginaw Brick Co. is today the oldest in this country.

From this start the number of companies rose to a great many and then settled back and is now increasing again, but at a much more sane rate. From 1901 to 1908 the greatest boom took place in this industry, the number of plants increasing from one to over a hundred, practically all of which operated more or less. During this period the majority of plants were started by promoters who knew nothing of the sand-lime brick industry, and so they left the operating of the plant to the owners, who probably knew still less about the business. It also seemed that any machine manufacturer who made presses of any kind got into this game, much to the sorrow of many brick companies. Of course such actions could only have one result and many companies failed during the next few years, so that by 1910 most of the culls were weeded out and only the better equipped plants were left.

From 1910 to 1912 the number of plants remained nearly constant. Then in 1912 to 1914 the business depression put more plants out of business. Then came the war and the after-war slump, which decreased the number of operating plants to 26 reporting to the government in 1921. At this time the sand-lime brick business started to improve and many new plants and old ones began operating, so that at the end of 1924 there were 37 reporting to the government and many others not reporting, so that the total would be around 50 sand-lime brick plants now producing.

The annual production of sand-lime brick increased from a total production of 20,860,000 brick in 1903 to a total annual production of 283,417,000 in 1924.

The future of the sand-lime brick industry looks good. It should be good as long as the proper type of people enter into it so as to prevent stock promotion schemes and poor brick getting into the market. The



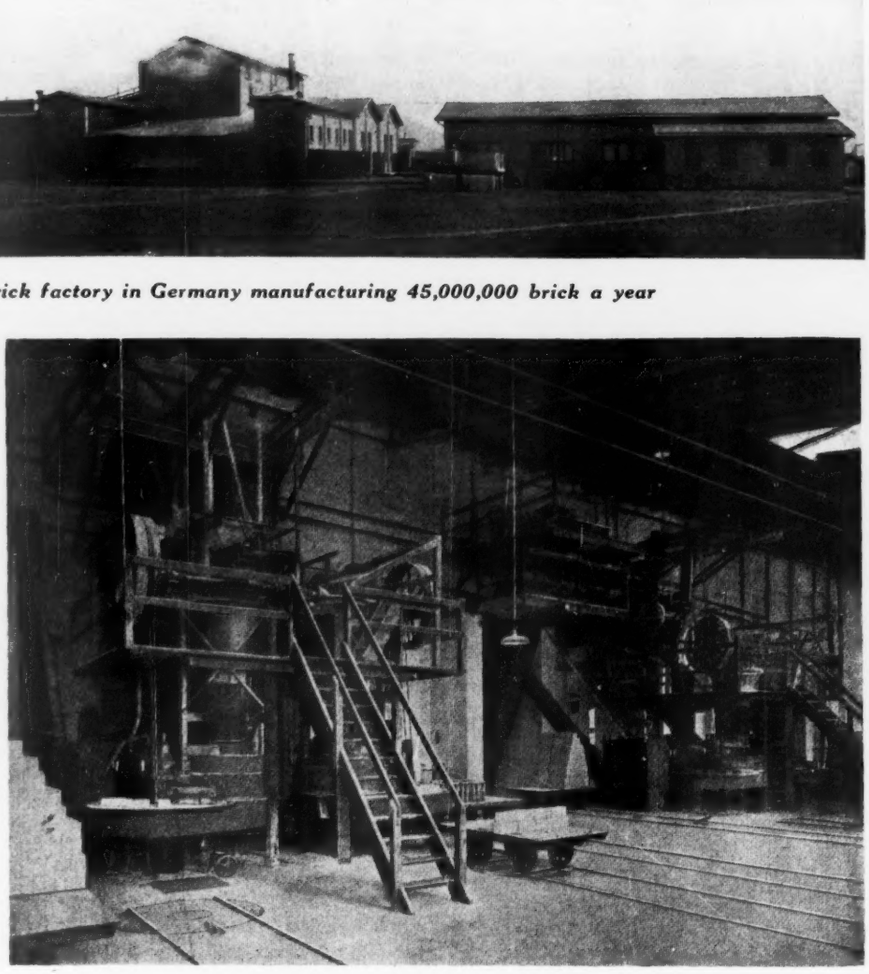
Shipping German sand-lime brick for export to the United States

A modern sand-lime brick factory in Germany manufacturing 45,000,000 brick a year

Sand-Lime Brick Association is organized to help prevent such troubles and help to keep the quality up, and a great deal of credit is due this organization for the success of this industry.

The Sand-Lime Brick Industry in Germany

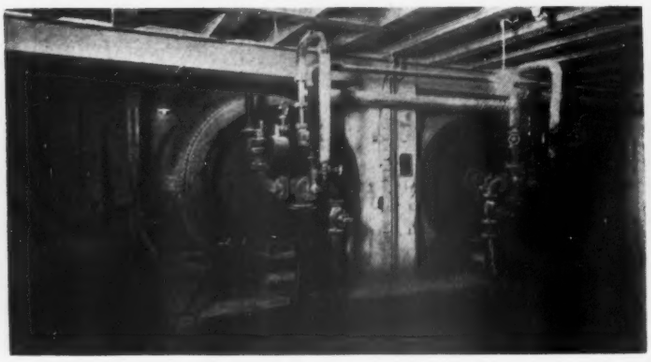
In the winter of 1898-9 the first factory for the production of sand-lime brick in large quantities was erected in Germany by F. Komnick. Nearly all the machines and apparatus necessary for this purpose had to a certain extent to be invented; nevertheless, everything went along without a hitch and the inevitable initial difficulties were soon overcome. This, it is said, was the first factory in existence to produce first-class sand-lime brick in great numbers, and experts came from all parts of the world to see it at work. The result of Komnick's experiments are shown by the fact that there are now over 700 sand-lime brick factories using Komnick process in different parts of the world.



Interior of the German sand-lime brick plant at Hamburg

The plant to be described is located at Hamburg, Altoona, Germany. It was erected and engineered by F. Komnick, and is equipped with Komnick process quick-lime drum machinery, one of the latest developments in the sand-lime brick industry. Sand is taken out of a nearby pit and transported to the factory by a dump car. It is hoisted to the top floor and dumped into a shaker screen and the screened sand drops into a sand hopper which is situated directly over the biconical mixing drum.

The lime used is ordinary burned lump lime, which is ground to a powdered state by means of a ball-mill, thus eliminating the cost of hydrating and the construction of bins and hoppers for storage of lime and sand. From there it passes to an automatic



Mixing drums at the Hamburg plant illustrated above

Pressure cylinders or kilns at the Hamburg plant

weighing device, which is so adjusted that no more lime is used than is necessary. This is also situated over the mixing drum.

The sand and lime is then allowed to pass into the mixing drum, the cover is bolted on the drum, and water admitted in a measured quantity and the drum set in motion making about one revolution every four seconds. A safety valve prevents the steam pressure from becoming too great.

After the drum has been in motion for about an hour, or until the contents are thoroughly mixed, the drum is stopped and the ingredients dumped into a container. From this container it passes automatically by means of an automatic shut-off gate into a distributing device which works in conjunction with an edge runner mill, and is thus evenly distributed below the runners which rub the sand and lime well into one another. In this way it is as thoroughly mixed and ready for the molding by one charge as was formerly obtainable only by passing the mixture several times through the mill. The mixture is automatically transported from the mill to the automatic feeder which regulates the flow and distributes it evenly through the agitator into the press where bricks are molded under a high pressure. The green bricks are pushed out of the molds automatically by a lever, giving the brick pickers time to remove them from the table to the trucks, thus avoiding broken edges. The green bricks are in such a state that anyone can remove the brick from the table to the truck without it falling to pieces in his hands.

the hardening cylinders and to generate the electricity, which is used as power.

The brick are taken from the cylinders and loaded on trucks by means of an electric hoist. This apparatus handles 1100 bricks at one time, three men having been known to unload 220,000 brick in ten hours' time.

A recent test was made by the Pittsburgh Testing Laboratory, Pittsburgh, Penn., of the brick made at Hamburg, with the following results:

COMPRESSION TEST

Crushing strength, 4019 lb. per sq. in.

ABSORPTION TEST

(One-half brick dried and submerged in water 24 hours)

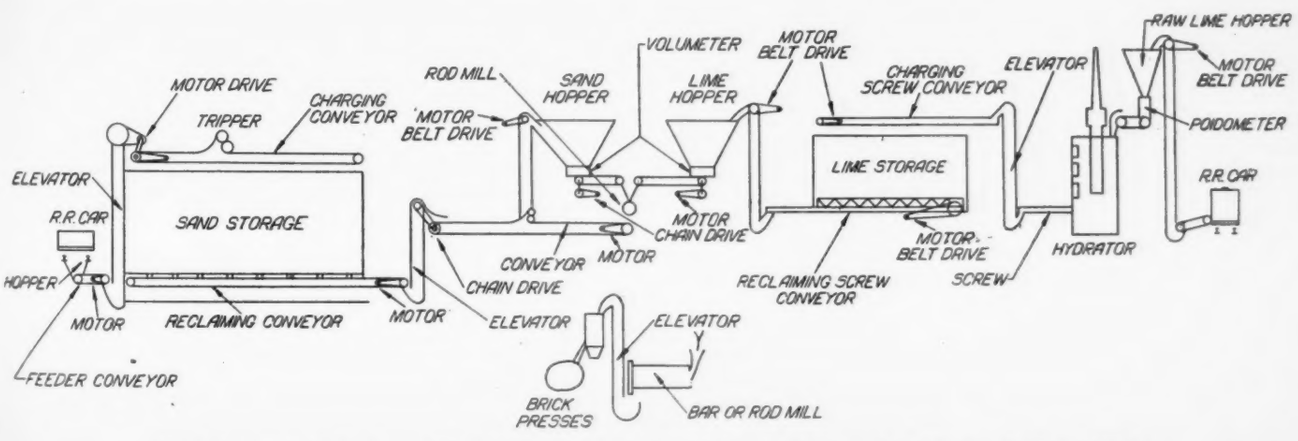
Original dry weight, grams	1900
Weight after submerged, grams	2040
Weight gained, grams	140
Gain, per cent	7.36
Fusion point of brick, deg. F	2822

Michigan's Newest Sand-Lime Brick Plant

That the manufacture of sand-lime brick is slowly but surely being established on a firm basis is evidenced in the report of the Bureau of Census for 1923. This report indicates that during the last 10 years the number of plants (to 1923) have decreased approximately 45% but the value of the manufactured product itself increased some 140%. This only means that smaller plants without modern equipment and methods have not been able to meet competition and have been forced out of business. The existing plants have grown larger and larger and

J. H. Schluchter, president (left), and J. G. Schluchter, vice-president and general manager (right)

with the advent of labor-saving machinery have been able to turn out a greater production as well as a better product itself. Architects and contractors in general have af-



Flow sheet of the new sand-lime brick plant of the Rochester Sand and Brick Co., Detroit, Mich.

The Hamburg plant has two mixing drums which furnish enough green mixture for four presses which are continuously in operation, each having a capacity of 2400 bricks per hour of the American standard size, which is 2¼x3¾x8 in.

After the brick trucks are loaded with green bricks they are run into the five hardening cylinders, which take care of the 96,000 brick output each ten hours. The bricks are placed under a steam pressure of 115 lb. for eight hours. Two 150-h.p. Cornish type boilers furnish the steam for

LIST OF MOTORS REQUIRED TO RUN VARIOUS MACHINERY IN PLANT

	H. P.
Sand feeder conveyor track hopper to large elevator	5
Same elevator to charging conveyor top sand bin including screen	15
Same conveyor through tripper top bin	7½
Reclaiming conveyor in tunnel under bin	7½
From same conveyor to elevator to inside conveyor elevator and conveyor one drive	7½
Same conveyor to elevator to steel hopper	5
Raw lime car to raw lime one-car capacity hopper	5
Poidometer reclaiming raw lime from above to Schaffer hydrator (slow speed)	5
Schaffer hydrator	15
Elevator from hydrator to charging screw conveyors	5
All units of charging screws and reclaiming screw conveyors	3½
Elevator reclaiming lime screw conveyor to steel hopper	5
Poidometer bottom steel hopper sand	2
Poidometer bottom steel hopper lime	1
Material meets here to rod mill	50
Rod mill to elevator to material hoppers on presses	5
Presses each including individual agitators and material hoppers	20
Total	183

Plant of the Rochester Sand and Brick Co., Detroit, Mich.; the car at the extreme left is discharging lime to the hydrator feeder

forded sand-lime brick recognition on the same basis as clay and other kinds of brick.

There are a good many sand-lime brick centers in the country. In Detroit, Mich., there are five plants within the city limits and six more within a radius of 100 miles. The newest plant in Detroit is the Rochester Sand and Brick Co. This company has been operating a one-press plant at Rochester, Mich., since 1913. After 10 years of operation at this plant, the output of which was directed largely to Detroit, the demands became so heavy that the company decided to erect a plant in Detroit.

In seeking a plant site the officials of the company were fortunate enough to purchase the buildings of what was at one time a foundry and with several changes and additions this made an ideal arrangement for a sand-lime brick plant. The site is such that raw materials such as lime and sand can be received in railroad shipments and the finished product, sand-lime brick can be delivered to any point in Detroit by motor truck.

Raw Materials

Sand originates at the company's sand pit located at Rochester, Mich., about 25 miles from Detroit. The sand is thoroughly cleaned and screened here. It is subjected to the same preparation and handled through the same equipment as that which the company uses in preparing asphalt paving top sand for use in the city of Detroit.

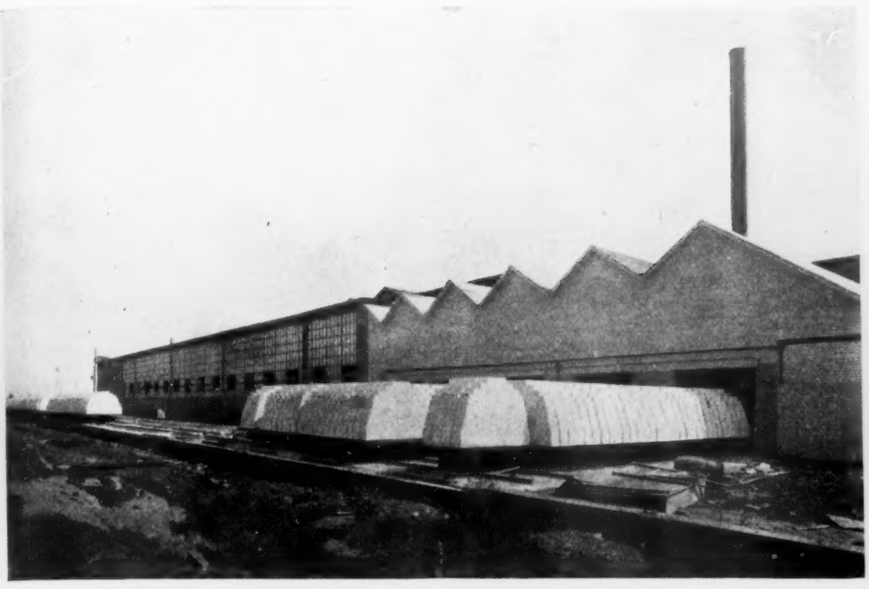
The following tests illustrate the texture of the sand:

A	
Mesh	Per cent retained
20	6
30	8
40	12
50	17
80	31
100	10
200	12
Passing 200 mesh	4%

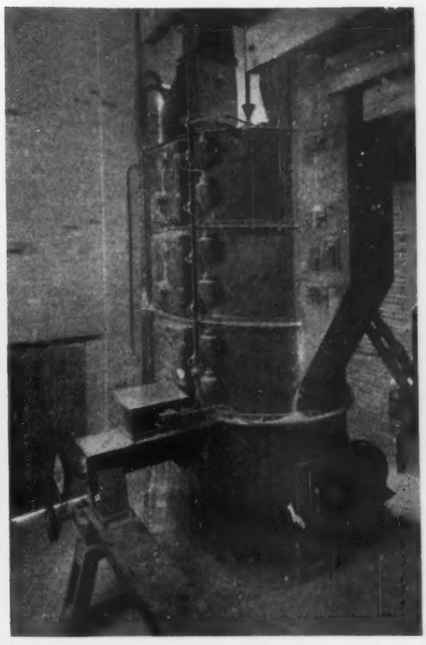
B	
Mesh	Per cent retained
20	5
30	8
40	11
50	20
80	31
100	10
200	11
Passing 200 mesh	4%

Sand is loaded in high-side battleship-type cars. These are brought to the plant in Detroit and spotted over a track hopper, underneath which is a short belt conveyor, 24 in. wide, 25-ft. centers. This acts as a feeder and discharges to a bucket elevator of 50-ft. centers, carrying 14x8x8½-in. malleable iron buckets on a 16-in., 6-ply special elevator belt. The elevator discharges to a 24-in. by 170-ft. belt conveyor fitted with an automatic tripper which discharges to any point

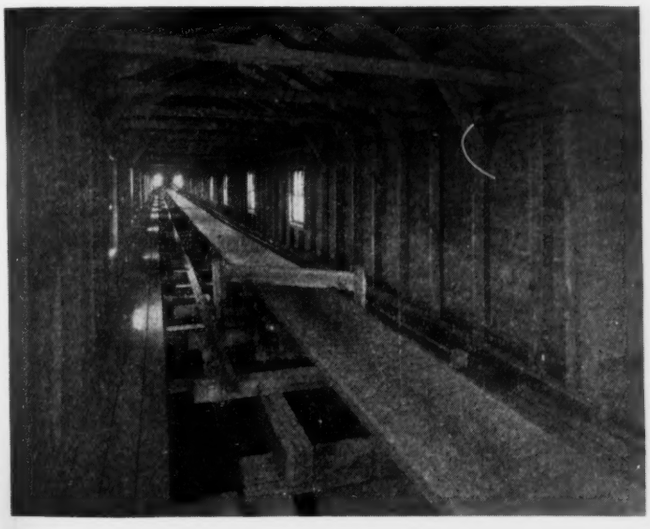
View of the brick presses and feeders; the cars have roller-bearing trucks and are pushed by hand to the steam-pressure cylinders



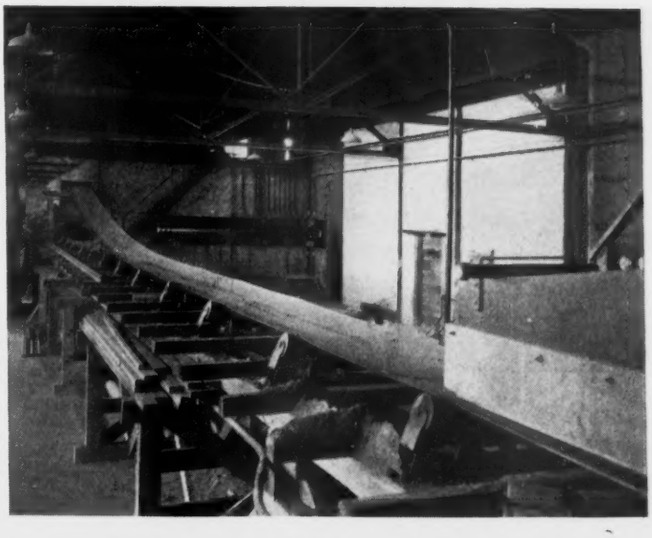
Storage yard of the Rochester Sand and Brick Co. plant showing cars of brick as they come from the steam-pressure cylinders or kettles; bricks are loaded on trucks and wagons at this point



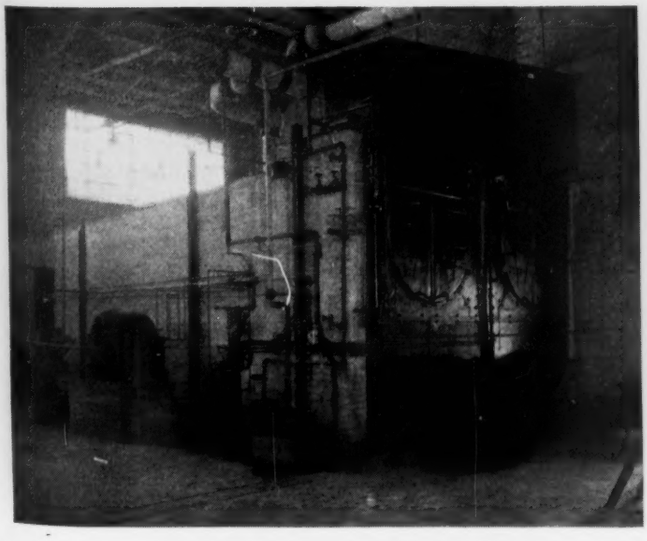
Hydrator is modern type



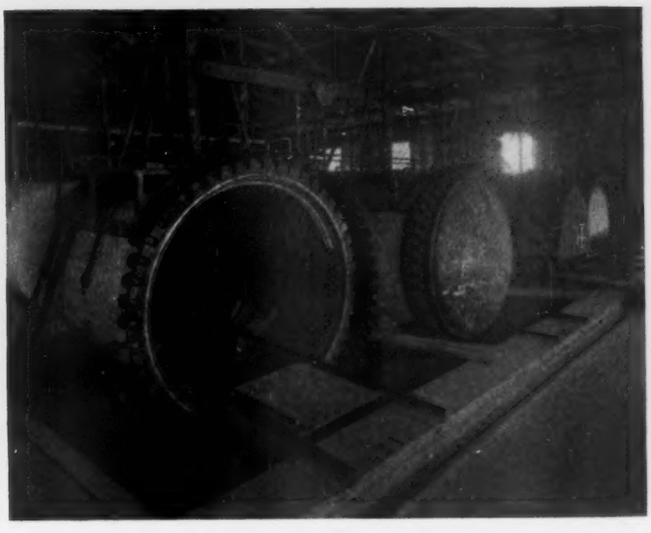
Belt conveyor taking sand to storage



Belt conveyor reclaiming sand from storage



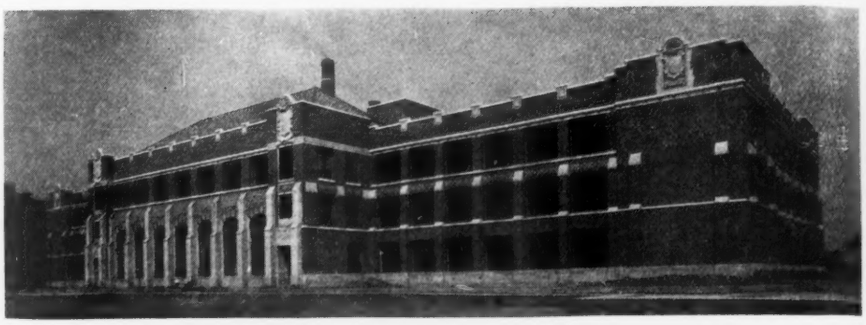
Boiler unit, equipped with automatic stokers



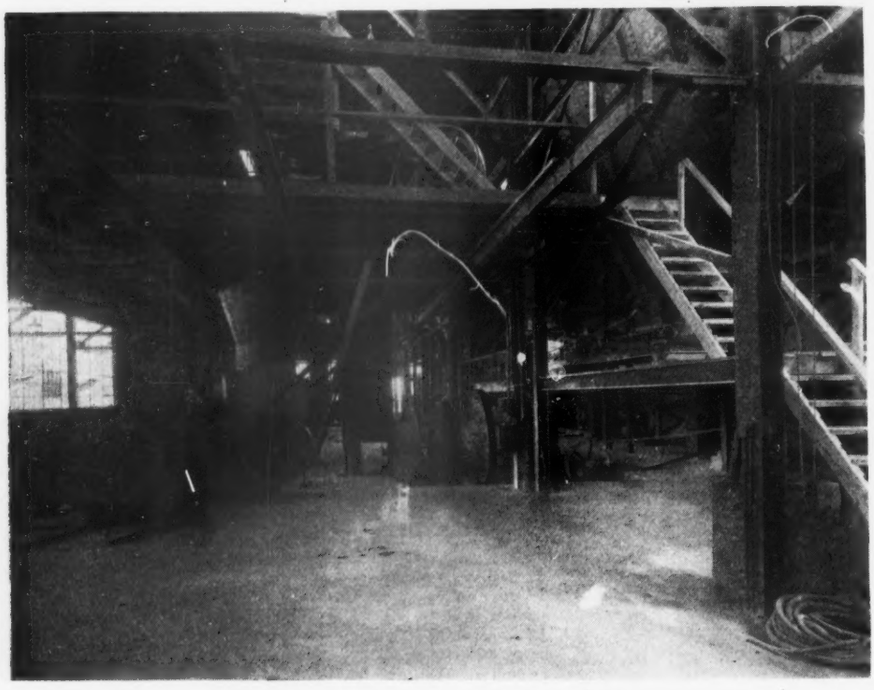
Steam-pressure cylinders and transfer tables

in the sand storage below. The above combination of machinery operates at a capacity of 150 tons per hour. The sand storage has a capacity of 100 tons and so in the time of a half hour it can be filled.

Underneath the sand storage and operating in a tunnel is another belt conveyor, 24 in. wide and 170-ft. centers. This conveyor is loaded through chutes in the roof of the tunnel and are spaced every 6 ft. center to center. The conveyor has a capacity of 150 tons per hour and discharges to a bucket elevator, 25-ft. centers. From this point by a combination of conveyor and elevator the sand is discharged to a hopper over the sand volumeter.



New Detroit school building built of Rochester sand-lime brick



View showing volumeters, rod mill and brick presses

Close-up of volumeters—one measures lime and the other sand; the point of common discharge leads to the rod mill

The burned lime is received in bulk and unloaded from box cars by a short belt conveyor discharging to a bucket elevator. This elevator, 46-ft. centers, with 7x4½x5-in. malleable iron buckets, discharges to the raw lime hopper located over the hydrator. The hopper has a capacity of 30 tons. The lime is drawn out of the hopper by a poidometer and fed direct into a Schaffer hydrator, which has a capacity of 8 tons per hour.

Hydrate discharges to a screw conveyor and by means of a bucket elevator and another screw conveyor it is sent to the lime storage. It is allowed to age here for a while. As needed, it is drawn out in a screw conveyor located in a tunnel underneath the lime storage. This goes to a bucket elevator which finally discharges to the lime hopper over the volumeter.

At this point the sand and lime are ready to be mixed and sent to a rod mill for further grinding and mixing. The volumeters underneath the sand and lime hoppers measure very accurately a predetermined portion of lime and sand. The discharge from each meets at a common point and is discharged to the rod mill. The mixture with moisture added is then conveyed to hoppers over the rotary presses.

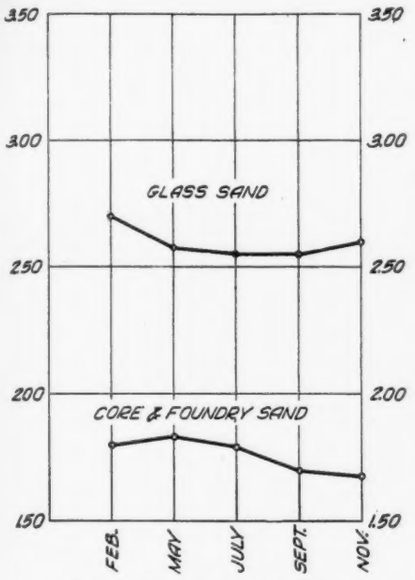
The brick presses are entirely automatic. Two men are stationed at each press and they pile the brick on flat cars. As each car is filled it is transferred to hardening cylinders or kettles. Here under the action of live steam at a pressure of about 125 lb. for a period of from 8 to 10 hours, the brick harden. After that period the cars are taken out and the brick is virtually ready to go out on the job. The company operates at the present time two presses and five kettles. Provisions have been made for doubling this capacity. All the cars used in the plant are fitted with Zerk (Alemite) nipples for lubrication. The kettles are insulated by the Johns-Manville Co.

All the brick machinery including presses, volumeters, kettles, cars, turntables, etc., was furnished by the Jackson and Church Co., Saginaw, Mich. Conveyors and elevators by the Stephens-Adamson Co., Aurora, Ill.

J. H. Schluchter is president of the company and has been identified with the sand-lime brick industry since 1908. J. G. Schluchter is vice-president and general manager. He has been associated with his father since 1913 and is the designer of this plant.

Silica Sand Industry in 1925

ACCORDING to the reports received from producers of silica sand there was an increased output for the whole United States in 1925 over 1924. This was largest in the Eastern states and it was partly balanced by a decline in production in the Southwestern states. Prices, as shown by



Price of silica sand in 1925

the accompanying chart, were higher at the beginning of the principal producing season than at the end, although there was a slight recovery late in the year.

Two new plants came into production in New Jersey, the plant of the Tavern Rock Sand Co., near Bridgeton, and the plant of the Pennsylvania Pulverizing Co. near Newport. Both these work unconsolidated deposits of a very pure white silica sand, using pump dredges to dig the material. Another new plant began construction late in the year, the plant of the Winchester Glass Sand Co. at Winchester, Va. Among the important plants built in 1924, but which began production in 1925, should be mentioned that of the Pennsylvania Glass Sand Co. near Mapleton, Penn. This is said to be the largest silica sand plant yet built.

The New Jersey plants contain Lewistown sand washers and steam dryers. The Pennsylvania Pulverizing Co.'s plant has two Lewistown pebble mills, 5 ft. 6 in. by 24 ft., in its grinding equipment.

In general, an increased production has been reported from the Maryland-West Virginia district, estimated by one producer to be as much as 20%. One company producing pulverized silica and special sands reported more than 40% increased output. The pulverized silica industry seems to be increasing steadily owing to its use in so many things in which production has increased.

In the Illinois field there was a great deal of activity. One of the principal producers reported a 10% increase and noted that the whole district showed an increase. Apparently the industries of that section are in a healthy financial condition, for the Ottawa Silica Co. retired its funded indebtedness and the Standard Silica Co. floated a good sized loan to purchase the Crescent Silica Co. There was a rumor current that the four largest producers of this section were to be consolidated. The Ottawa Silica Co. was reported to have bought large acreage for reserve and to have made important improvements in its plant. The output of "crude" silica from this field is reported to have increased.

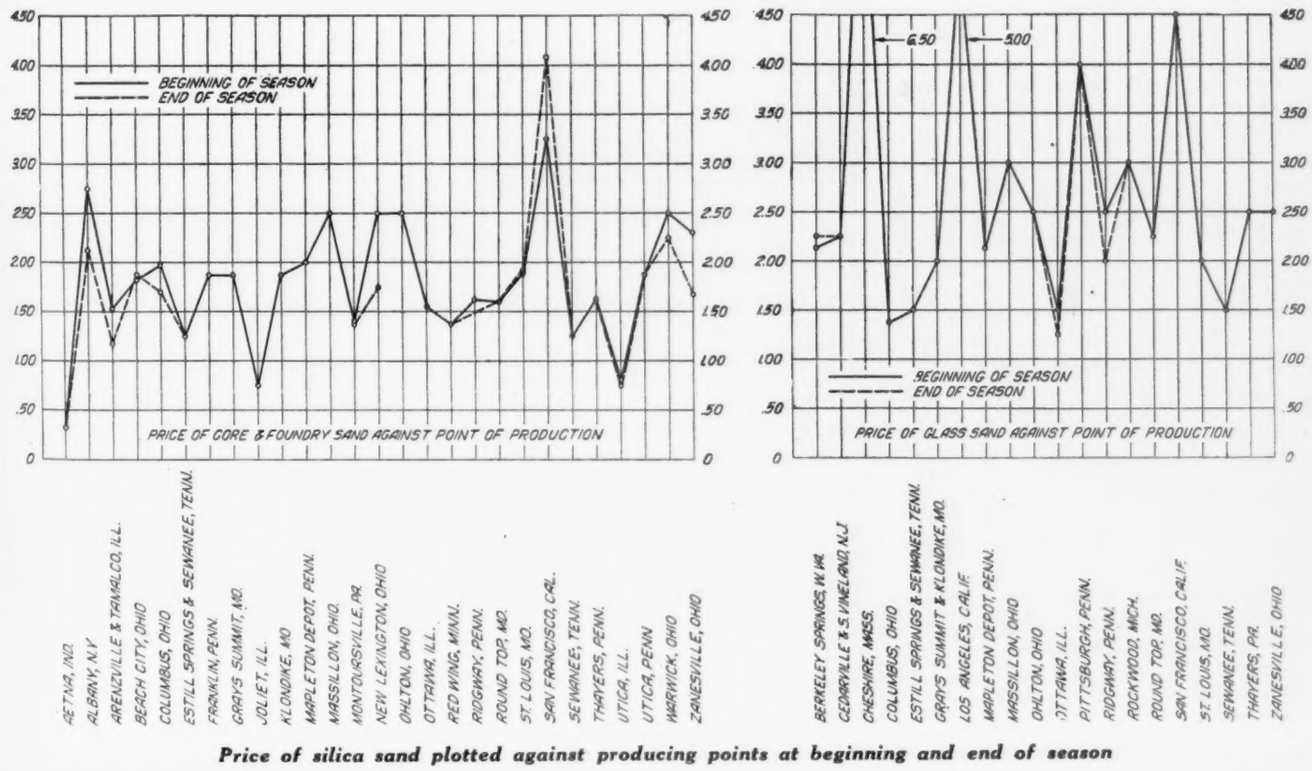
In the Missouri field the plants were reported to be working steadily. The recently built Pioneer Silica Products Co.'s plant put one unit in operation and probably has others in operation by this time. This produces ground silica, air floated. In the Arkansas field it is said that building was begun on the new plant of the American Silica Co. at Rogers.

From the Ohio field it was reported that a 300-ton plant would be built by the Central Silica Co. at Glass Rock. The Brilliant Sand Co. at Brilliant is said to have purchased two quarries.

On the Pacific coast, the Western Silica Co. of Yakima, Wash., rebuilt a portion of its plant and replaced equipment that was damaged by a fire. It was reported recently that two new plants were to be built in California, one near Hermet and the other near Corona.

Decreases were reported from the Southwestern field, one producer estimating the decrease as 15%. A part of this territory was subject to a severe drought and generally bad business conditions.

The finding of new deposits was reported from several parts of the country. One of the interesting discoveries was in Minnesota. It was reported that this was suitable for making plate glass and that Henry Ford had been investigating it with a view to using it for that purpose.



Price of silica sand plotted against producing points at beginning and end of season

Work of the Non-Metallic Minerals Experiment Station During 1925*

By Oliver Bowles

Superintendent, Non-Metallic Minerals Station, Bureau of Mines, Department of Commerce, in Co-operation with Rutgers University, New Brunswick, N. J.

THE New Brunswick, N. J., Experiment Station of the Bureau of Mines was established on July 1, 1923 to disseminate information, conduct original research, and provide other practicable technical service to the great group of non-metallic mineral industries. The regular technical staff consists of four members, although several additional engineers have been temporarily employed. The New Brunswick station is to be regarded as a commodity station rather than a regional station; that is, its activities are not confined to the immediate district where the station is located, but are directed toward a special group of mining industries distributed throughout the entire country.

Field Work

The field covered by the work of this station is very extensive and in many of its branches little fundamental research has been accomplished. In the important branch of structural materials, such as stone, cement, lime, and gypsum, many of the problems are of such a character that they can not be worked out in a laboratory; they require field study and experimentation conducted at the mines, quarries, and mills under commercial conditions. On this account field studies carried on co-operatively with the industries constitute one important branch of the work. Laboratory studies of the physical and chemical properties of the minerals or their primary products, particularly in relation to problems of utilization constitute the second important branch. A third, and less important branch may be termed "compilation," the accumulation of data from various published articles or from correspondence and its compilation into reports. Added to this is individual service in answering inquiries on the nature, qualities, uses and distribution of minerals or rocks, and questions on equipment and methods of operation to be employed in development or primary manufacture.

Lime plant studies.—A study of quarry problems in the lime industry was conducted by the superintendent for about two years prior to the establishment of the station, and this investigation was transferred from Washington to the new station as a part of its regular work. A total of eight short papers on various phases of lime-plant quarry operation were issued at intervals as mimeographed reports of investigations, six from Washington and two from the New Brunswick station. These reports were based on detailed studies of many lime plants in the Eastern and Southern states. During 1925 additional field studies were made in Virginia, West Virginia, Maryland, and Ohio. The short reports, together with much additional information, have been compiled into a bulletin now awaiting publication.

Calcination of small-sized limestone.—One

Dr. Oliver Bowles

of the outstanding problems in the lime industry is to devise means whereby the tremendous tonnage of small-sized limestone fragments now largely unused in lime burning may be successfully and economically calcined into lime. A careful study has been made of existing methods of calcining small stone, notably the use of the rotary kiln. In co-operation with an equipment manufacturer and with several lime-plant operators, extensive experimental work has been conducted with a type of machine entirely new to the lime industry. The tests have been nearly completed and quite encouraging results obtained. This work is under the immediate direction of W. M. Myers.

Garnet milling.—An important function of the station is to bring to the non-metallic industries the accumulated knowledge gained in metallic ore milling, and to work out such modifications as are necessary to apply these methods in a practical way. An important step in this direction was the temporary assignment of C. O. Anderson, who had had long experience in lead and zinc ore milling, to work with W. M. Myers of this station on a study of garnet milling. A complete analysis was made of mill operation at North Creek, N. Y., and to a lesser extent in New Hampshire and North Carolina. A short report, "Recent Developments in the Production and Consumption of Abrasive Garnet," Serial No. 2691, was issued in June, 1925, and a more complete bulletin covering all details of the subject is now in press.

Limestone mining.—Owing to the increasing importance of underground limestone mining a temporary appointment for nine months was obtained for J. R. Thoenen, a mining engineer of wide experience, to make a detailed study of the subject. Visits were made to 52 out of a total of 64 mines now in operation, and a report analyzing the different methods employed was prepared and is now awaiting publication.

Production and use of metallurgical limestone.—A study has been undertaken by Oliver Bowles covering the whole production and utilization of limestone and dolomite used in metallurgical work. The desirable qualities and methods of application are little understood by the producer, and on the other hand many of the consumers are unfamiliar with the producer's problems. The purpose of the work is to co-ordinate these two groups by compiling as complete information as possible on every branch of the subject. The study embraces metallurgical literature, quarry operation and smelter practice.

Laboratory Investigations

Hydration of anhydrite.—Anhydrite which occurs in large quantities at some gypsum mines, and as a by-product in some chemical industries, is difficult to utilize. The desirability of hydrating it to a form in which it could be used for calcined products led Marie Farnsworth, physical chemist, to devise some practical means of hydration. A method of fairly rapid hydration by fine grinding was worked out, and the product calcined to a plaster of paris of high quality. Commercial application of the method to the use of waste anhydrous calcium sulphate is now being tried out. The results of the work conducted at this station were

*Published by permission of the Director of the Bureau of Mines.

published in *Industrial and Engineering Chemistry* (and in Rock Products, November 14).

Anhydrite as a cement retarder.—At the request of the gypsum industries, E. E. Berger, physical chemist, undertook a series of tests to determine the adaptability of anhydrite as a cement retarder. Very thorough tests were made on 18 samples of cement from various parts of the country. It was found that anhydrite alone is not a good retarder though it gives good results when mixed with gypsum. The tests were completed during the year, and the results published in September in Serial No. 2705 and in abstract, Rock Products, October 31.

Re-use of plaster of paris.—A study was made by Marie Farnsworth of the deterioration of plaster of paris by re-use, and a reason therefor. A marked deterioration in strength was noted. Through the kind co-operation of the physics department at State College, Pa., and the department of chemical engineering of Massachusetts Institute of Technology, Cambridge, Mass., an X-ray investigation is now under way to determine a possible relation of increasing weakness to crystal structure. The application of X-ray to industrial problems is a notable recent development in physical chemistry. The Portland Cement Association has recently engaged the services of an X-ray specialist under a fellowship at the Bureau of Standards.

Calcining as an aid in grinding.—Flint is calcined prior to grinding by some operators and W. M. Myers ran a series of tests in the laboratory to determine the advantage of such a process. It was found that calcination did materially assist grinding, but that with the use of modern grinding equipment the advantage would probably be insufficient to justify the extra expense of calcination. Materials for testing were obtained from feldspar and flint grinding mills in Trenton, N. J. The results of this work will shortly be published in the Journal of the American Ceramic Society.

Fluorspar ore concentration.—In June, 1925, a co-operative study was begun at the Mississippi Valley station, Rolla, Mo., to determine possible improvements in the milling of fluorspar ores. In present milling practice much spar is lost in the tailings. Samples of tailings from the Rosiclare, Ill., district were taken to Rolla and concentration tests were run using a type of jig developed by the bureau. The work is incomplete at the end of 1925, but very favorable results have been obtained on material between 2 mm. and 28 mesh (.589 mm.) size, 85% of the spar of this size being obtained in a concentrate running above 90% CaF_2 and with less than 2% SiO_2. This indicates the possibility of easy recovery of much of the fluorspar now wasted. The testing work is conducted by Messrs. Coghill and Anderson, who have worked out many improvements in the treatment of lead-zinc ores.

The effect of steam on limestone calcination.—At many lime kilns of the shaft type a jet of steam is employed beneath the grate to facilitate calcination. The actual effect of the steam is not well understood, many different opinions have been expressed regarding the actual office it performs. A series of tests are being conducted by E. E. Berger in the New Brunswick laboratories to determine if possible the effect of steam on time and temperature of calcination.

Miscellaneous studies.—Brief studies have been made of such problems as the milling of kyanite and feldspar, the separation of magnesia from dolomite, the use of the wire saw in slate quarries and the utilization of greensand. Such work is preliminary in character, its object being chiefly to determine the wisdom of undertaking special studies in these subjects.

Dusting materials for coal mines.—Most of the work on this subject was completed during 1924 but the report by Oliver Bowles with 15 maps showing the location of gypsum mines and limestone quarries from which dusting materials might be obtained to prevent dust explosions in coal mines was released for distribution in July, 1925. The dusting method is being introduced in many coal mines, and this should open up a market among limestone and gypsum producers to provide the necessary materials.

Published Reports

The following reports have been issued by the New Brunswick station during 1925:

1. Sources of Limestone, Gypsum, and Anhydrite for Coal Mine Dusting to Prevent Explosions. Bureau of Mines Bulletin 247, by Oliver Bowles.

2. The Hydration of Anhydrite. By Marie Farnsworth, *Industrial and Engineering Chemistry*, Vol. 17, No. 9, p. 967, September, 1925.

3. Recent Developments in the Production and Consumption of Abrasive Garnet. By W. M. Myers, Reports of Investigations, Serial No. 2691, June, 1925.

4. Asbestos in 1924. By Oliver Bowles, Mineral Industry.

5. Mica in 1924. By W. M. Myers, Mineral Industry.

6. A Fulgurite from Perth Amboy, N. J. By W. M. Myers, *American Mineralogist*, Vol. 10, No. 6, June, 1925.

7. The Mining and Preparation of Feldspar and Flint. By W. M. Myers, *The Ceramist*, Vol. 6, No. 2, May, 1925.

8. Chapters on "Slate" and "Mica." By Oliver Bowles, in *The Marketing of Metals and Minerals*, McGraw-Hill, 1925.

9. Calcium Sulphate Retarders for Portland Cement. By E. E. Berger, Report of Investigation Serial No. 2705, September, 1925.

10. Physical Chemistry of Calcium Sulphates and Gypsum Reserves. By Oliver Bowles and Marie Farnsworth, *Economic Geology*, December 15, 1925.

11. Some Important Problems in the Lime Industry. By Oliver Bowles, Rock Products, July 25, 1925.

The following reports were in press at the end of 1925:

1. Garnet: Mining, Milling, and Utilization. By W. M. Myers and C. O. Anderson, Bureau of Mines Bulletin 256.

2. Quarry Problems in the Lime Industry. By Oliver Bowles and W. M. Myers, Bureau of Mines Bulletin —.

3. Underground Limestone Mining. By J. R. Theonen, Bureau of Mines Bulletin —.

4. Calcining as an Aid in Grinding. By W. M. Myers, *Journal of the American Ceramic Society.*

Co-operation of the industries.—The above outline gives briefly the principal activities of this station during 1925. Acknowledgment is due to many of the companies producing non-metallic minerals for their cordial co-operation in supplying material for testing purposes and for data furnished through conferences with them. Without the information supplied as a result of their practical experience several of these problems could not have been carried to a successful conclusion. Further co-operation is greatly desired. The non-metallic mineral industries should recognize this branch of the federal government as being set apart particularly for their service. To be effective, co-operation is required in bringing to the attention of this station the needs of the industry as brought out in every day industrial practice. With small personnel and limited funds the station may not be able even to attempt every problem suggested, but careful consideration will be given to every proposal, and more than ordinary importance will be attached to those problems emanating from the industries themselves, for a voluntary request for assistance is interpreted as representing a real need of the industry. The solution of urgent industrial problems is the type of service which this station desires to render.

Stone—Ten Thousand Years Ago and Now

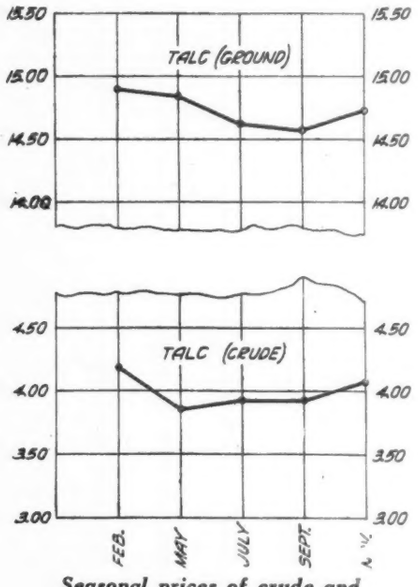
THE above is the title of an unusually attractive, illustrated book put out by the Walker Cut Stone Co., Tacoma, Wash. There is a little story of the history of stone or rather how stone is always connected with the history of civilization. From earliest times, men built of stone and their works are sketched to contrast with the great modern memorials, libraries, public buildings of the present day which are shown in sepia on the book's pages. The effect of beauty is always present, whether in the early temples or the modern stately edifices. Homes built of it show that quaint beauty in their ruggedness that is always characteristic of stone. Built today and still living after many tomorrows.

There are also shown some illustrations of the Walker sandstone quarries and their plant which portray the extensive character of the company's operations.

Talc and Soapstone Production in 1925

BECAUSE of the great variations in the quality and uses of talc and soapstone, the industry cannot be considered as a whole. The different producing localities furnished many grades so that they were differently affected as to price and production dependent on the condition of the industries they served. For example, talc is used in the paint, textile, rubber, foundry, prepared roofing, cosmetics and many other industries, and an operation supplying any one of these might be affected without those operations supplying the other being affected at all.

On the whole, the year 1925 may be considered to have shown a considerable improvement over 1924. As observed in last year's review, the early part of 1924 was



Seasonal prices of crude and ground talc

particularly bad and many mills were forced to shut down or curtail production. This was due to mainly the general business depression that hit the country. About August, business conditions began to improve, especially for those manufacturers of products for the building trade and this was reflected by an increased demand for talc so so that by the end of the year the industry was back to about normal and particularly good for those producers supplying the roofing and rubber trade. This good demand was probably on account of the anticipation for the big year to follow in these industries.

The year 1925 began with an increased production for practically all grades of talc and continued so throughout with preparation made for an even greater increase for 1926. As said before, the influence of the varied industries, was felt. The prices were higher than those of last year and showed only a slight depression as the end of the year approached. There were few new companies to enter the field and only about $500,000 more capital invested of which only $100,000 came from two new companies.

While no definite figures on Vermont are available, there probably was a greatly increased production over that of 1924. This was on account of the product of that locality being used chiefly in the rubber, roofing and paper industries, all of which enjoyed a prosperous year. Prices showed a good increase and were generally firm. For 1926, prices will probably remain the same or, if anything, show an increase until about the latter part of the year and then a decrease. There were no new producers reported in the district.

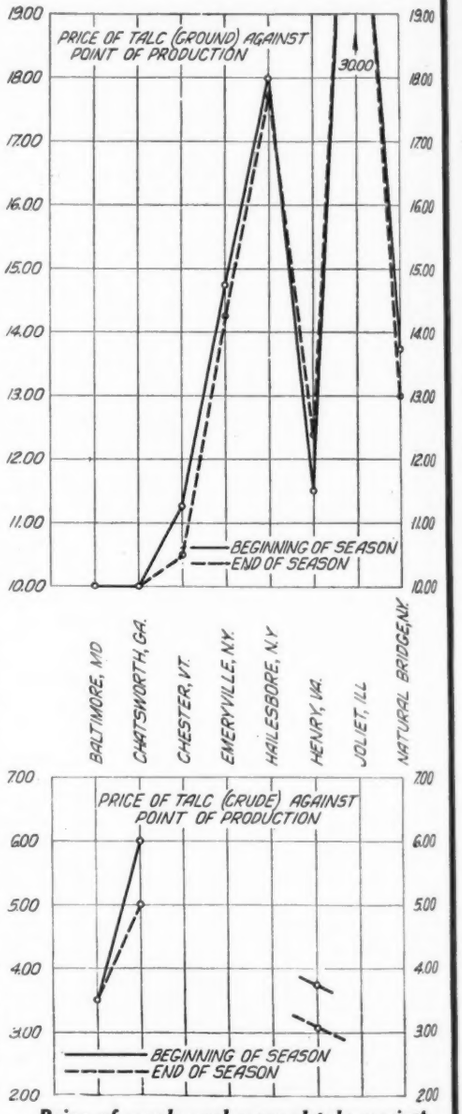
The production of talc in Virginia showed increase over 1924, one producer of importance reporting 120% increase over 1924. The price received was somewhat lower, one reporting a decrease of 12%. A good part of the talc and soapstone produced has been shipped to foreign countries, particularly Cuba and in this last year this has been increasingly true. While there has been only one new producer to enter the field, there have been some notable consolidations.

As a result of these mergers and acquisitions of holdings, there is vested in one large New York company, three important talc and soapstone properties of the Virginia district and one in Maryland. Several companies have changed owners and in one particular case, a large amount of new capital invested. The outlook for 1926 is promising, several producers having reported that they expected a far greater production for that year. Here again, prices will be doubtful but are expected to be firm with a steady demand.

In North Carolina, the industry shows signs of a revival. Up to the 90's, this section marketed nearly all the talc used in the United States. With the opening of the Gouverneur deposits in New York and because of the somewhat worked out condition of the best deposits in the state, talc production showed a rapid decline. Nearly all the different grades of talc are found in the state. At present, pyrophyllite or "coarse" talc and which is used chiefly as a filler for the poorer grades of paper, makes up the greater part of the state's output. The better grades known as "magnesium" talcs occur in well defined veins in the marble deposits throughout the western part of the state. The demand for all grades is good and accordingly the past year has shown an increased production. Several new companies have been formed, one of which is said to have acquired 1000 acres of "magnesium" talc land and is expected to be a large producer in 1926.

One small producer of talc for the textile and rubber trade in Illinois reports 25% increase in production with about the same price as last year. He expects to increase production in 1926 and prices to remain firm as of 1925.

The New York district production exceeded that of last year. Some of the producers reporting an increase of 40%. The talc of this locality (St. Lawrence district) is the fibrous kind generally called asbestine and is used chiefly in the paint and paper trade. Production for 1926 will depend largely on the conditions in these two industries and the possible opening of new markets by the development of new uses.



Price of crude and ground talc against point of production

The W. H. Loomis Talc Corp. of Gouverneur, N. Y., which has been a pioneer in the development of improved grades of asbestine and the adoption of better milling processes has been working for a number of years to find new uses to which talc could be put. At the end of 1924, it was announced from their research laboratory, especially established for the purpose, that concretes made with talc showed increased

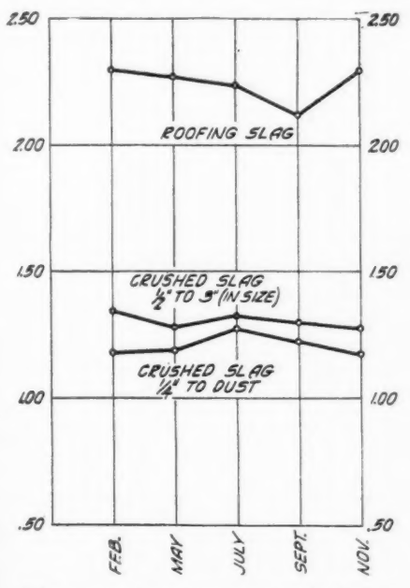
strength and waterproof qualities. This year the work has been continued extensively in order to find the best proportion of talc to add to concrete mix. The company is now marketing a compound called "Loomite" for use in concrete mixes which is said to materially strengthen and make more waterproof the finished product. These claims are based on a long series of tests made on concrete specimens and following regular A. S. T. M. test methods and which show a distinct advantage in strength and time of set. The exact proportion to be added to the mix have as yet not been fully determined, but best results so far have been with a 5% talc (in total aggregate, by weight) of a 1:3 sand-gravel mixture and which corresponds to a talc content of 20% (by weight) of the cement used. The company has had a concrete made with lesser proportion of talc (3%) in use for three years on the floors of the plant over which a moving load of 1000 lb. on small wheel trucks is continually passing. Concrete of this sort has also been used with success at this plant for waterproofing walls and elevator pits.

Ground talc, molded into form and then calcined, has been found to be as hard as quartz. This has been made at the Columbus, Ohio, experiment station of the Bureau of Mines. The product is said to have excellent di-electric qualities and can be made from a low grade talc. The previous practice has been to carve out the necessary models from soft talc and as a consequence of this, there has been a large loss before burning can be completed. The Bureau has shown that by the new molding process, the product can be calcined with but little breakage.

Crushed Slag Industry in 1925

SLAG had what might be described as a moderately good year; that is, there was an increased production, but the increase does not appear to have been so large as in some other branches of the rock products industry. Prices held fairly level, although the chart shows a slight tendency to decline in common with the other mineral aggregates. A tonnage estimate made by one who is familiar with the industry shows that production will not be much below 8,000,000 tons.

Part of the increased production was due to the starting of new plants. The Standard Slag Co., which operates a number of plants in three or four states, erected its seventeenth plant at Youngstown, Ohio, late in 1924. This plant was in full production throughout 1925. In the South the Woodstock Slag Corp. of Birmingham, Ala., built a new plant and later made improvements. It was reported late in the year that the Illinois Slag and Ballast Co. would build a new plant.



The season's prices on crushed slag

Business was reported very good for the Birmingham companies, as a large part of their production is shipped to Florida where the demand for building material has been enormous, and where a great deal of crushed slag is used even in normal times.

Some research work was entered into by some of the larger companies to find new uses for crushed slag and better ways of using slag in the known ways. It is especially desired to find ways of using the finer sizes of slag variously known as "slag screenings" and "slag sand." One investigation showed that careful grading of this material would make it into an excellent fine concrete aggregate, not only where strength is required, but where good finishing qualities were needed. The strength of concrete made with slag screenings has always been very satisfactory.

There has been a decided increase in the use of crushed slag for concrete products. A Rock Products editor in a trip through the Eastern states noted a preference for slag at several plants where the material could be obtained at a reasonable cost per ton, this preference coming from the lighter weight which made it a cheaper aggregate. It also makes a lighter block by about five pounds for the standard 8x8x16-in. size.

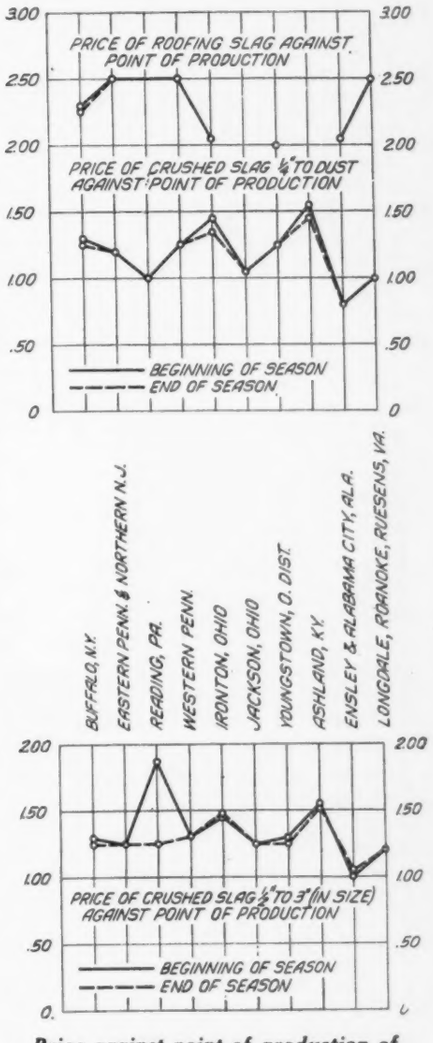
The prospects for the coming year appear to be excellent, and producers are preparing for an increased production in order to meet an increasing demand.

The following view of the slag situation has been prepared for Rock Products by C. L. McKenzie, president of the National Slag Association:

Editor Rock Products: It seems to me that the "prospects for 1926 as compared with the present year" can be stated in the one word, GOOD; or, in other words, the prospects are that slag business will be better in 1926 than it has been in 1925.

Anyone who reads a few (maybe a couple of dozen) of the daily, weekly, and monthly analyses and prophecies of business put out by the statistical organizations, business review departments of banks (including Federal Reserve), trade journals, and "house organs," etc., has been informed that business in general for the United States is better this latter half of 1925 than it was in the spring. He also knows in that manner and by general observation, that business as a whole is still good—probably increasingly so. If anyone asked how long it will last, I'd be inclined to refer him to the statistical authorities or expert reviewers. Otherwise expressed and quoting a well-known individual, "All I know is what I see in the papers"—and that might be pretty accurate as applied to a lot of us.

One item of general information is that



Price against point of production of crushed slag

states, cities, counties, townships, boroughs, and districts have acquired debts heretofore and still have a lot of the money to spend. Many are able and willing to acquire more debt with which to pay for great quantities

of that excellent and useful structural material—blast furnace slag—and other materials similarly or otherwise useful.

Also the railroads are having somewhat improved earnings (no doubt to continue with the widespread large volumes of shipping). This likely will result in considerable purchases, and the mineral aggregates industries should benefit along with others. There are other favorable features including probable increased industrial building to offset the moderate slackening in residence building and similar construction.

Excess capacity (approaching, it seems, even in the production of mineral aggregates), increasing local taxes, effects of changes in European and world conditions of business and crops, include possible developments that would work against long continuance of high prosperity for the United States. Such developments, of course, can affect any one or all lines of trade—some more at one time and others more at another time. My personal opinion, or guess, is that 1926 will not present serious obstacles to successful progress in the slag business.

We who look after the slag company with which I am connected hope that a kind Providence will arrange matters so fortunately that we may not have to spend much more than our profits in buying the new and improved (labor and money saving) equipment so alluringly described in your advertising pages. If so, we may pay dividends. Experience, however, teaches that the aforesaid Providence only trades the dividend privilege for substantial contributions of mental and physical labor, applied with energy, ingenuity, and enterprise—conscientiously. Our industry (and others) no doubt must count on earning it if we have the financial prosperity hoped for. To a practical certainty, it will require more earning in future than for some time in the past.

C. L. McKenzie,
President, Duquesne Slag Products Co.

Fluorspar Production in 1925

[Fluorspar has not shared in the general prosperity of the rock products industries in 1925. The reason is that it is subject to heavy competition from foreign sources and the tariff does not seem sufficient to equalize the difference in the European and American costs.

In order to give its readers an authoritative view of the present state of the fluorspar industry, Rock Products has requested G. H. Jones, president of the Hillside Fluor Spar Mines, which are at Rosiclare Station, Ill., to prepare the article on the fluorspar industry which follows.—The Editors.]

FLUORSPAR is a comparatively unknown non-metallic mineral of moderate cost, widely distributed geologically but of commercial value only in a few places in the world. It finds about 85% of its production going to steel makers for use as a flux and a detergent in basic open-hearth and electric furnaces.

The United States is able to produce more fluorspar than the rest of the world put together, but owing to a slackened demand for it in European countries, imports, chiefly from England and Germany, have been increasing. In 1924 imports aggregated 51,000 tons, and 1925, when all information is in, will show about the same tonnage imported.

This year started with large stocks of concentrated fluorspar at the mines, and comparatively large stocks at the points of consumption. Much of this has been liquidated during the year, but mining operations have not corresponded with the consumption of fluorspar and have been subnormal. It is doubtful if the heavy production of steel now existing will continue throughout 1926. Provided imports do not increase, the domestic production would not be equal to the demand.

There has been among some of the leading producers a struggle for all the tonnage going, with the result that low and unprofitable prices have ruled during the year, which have been barely enough to cover the actual cost of mining, without the proper charges for exploration and development work, depreciation and depletion.

Probably about 160,000 short tons were consumed in 1925, representing a cost of mining of about $3,000,000.

A large tonnage of "acid" fluorspar has been coming from South Africa, chiefly for use in making hydrofluoric acid. Other uses for high-grade spar are, for enameling and glass making, electrically refining lead, and by foundries as a flux.

With a tariff of $5 per short ton, it would seem imports could be minimized, but on account of the cheap European labor and the fact that no real mining is involved in getting out the European spar, which comes mainly from old dumps and shallow quarry workings, and because the foreign spar is brought in at ballast rates on the Atlantic, foreign spar is used almost exclusively along the Atlantic coast, and has penetrated as far west as Pittsburgh.

Deep mining, much water and high wages in American mines as well as high inland freight rates have also made it possible for the domestic mines to be undersold by the foreign product.

Higher prices will have to rule in the near future, otherwise mines in the United States will be obliged to shut down until the demand and price justifies them in resuming operations.

A high tariff, double the present one, would be helpful to producers and would not penalize steel makers to an extent worth considering, as they are now using no more than 8 to 10 lb. per ton of ingots produced in average operations.

The War Industries Board considered the mining of fluorspar an essential industry and during the war did all in its power to develop the production.

No new discoveries of fluorspar of any consequence have been made during the last ten years, and the reserves of the known deposits are not large.

Practically all the fluorspar produced in the United States comes from Hardin county in Illinois and the adjacent northern counties in Kentucky.

On the whole, during this year, the fluorspar industry has been in a bad way, and the outlook at this time for 1926 is not promising.

The Slate Industry in 1925*

By Oliver Bowles
Superintendent, U. S. Bureau of Mines Experiment Station, New Brunswick, N. J.

THE slate industry was originally confined largely to the production of roofing material, but the adaptability of slate for various uses led to many other developments, some of them attaining an importance equaling if not exceeding that of roofing. The important branches of the industry today are roofing, structural and sanitary, electrical and blackboard. School slates are manufactured by a few companies, mostly for export trade. Granule manufacture might be regarded as another branch, though it has little in common with the chief divisions of the industry. The utilization of waste is gradually assuming rank as an important by-product development. Waste is used to some extent for granules, though the granule industry obtains most of its raw materials from quarries in solid ledges, having no connection with other slate quarries. Waste slate in pulverized form is utilized to some extent as a filler in such products as paint, linoleum and roofing mastic. There have been no notable developments in the utilization of waste in the United States during 1925, though in England noteworthy progress has been made in the application of slate dust to roads.

In so far as production is concerned the slate industry barely held its own during

*Published by permission of the Director of the Bureau of Mines.

1925; when final figures are available it will probably appear that production has fallen below the 1924 figure. This circumstance is, however, no cause for alarm or apprehension, its underlying reason being temporary, for it is due mainly to the occurrence of strikes in two important slate-producing districts. During the early months of 1925 roofing-slate production in the Pen Argyl district of Pennsylvania was not more than 50% of normal, owing to the protracted strike which was not officially ended until August. The strike did not materially affect the structural branches of the industry. In May, 1925, a strike was called in the Granville, N. Y., district. One operator made terms with the strikers, but all others affected are operating on the so-called American plan —that is, men are employed irrespective of any affiliation they may have. The strike was still unsettled at the end of the year. It greatly reduced the production of the weathering or sea-green slate. As a result of strikes the stocks of roofing slate in these two districts have been almost depleted.

An important development in the roofing-slate industry in Pennsylvania is the erection of mills for sawing blocks ready for the splitters. The mills are also provided with labor-saving machinery—such as electric cranes for handling blocks and finished slates, and belt conveyors to carry away waste resulting from splitting and trimming. This new departure makes roofing slate manufacture much less arduous than it was under former conditions where practically every operation was conducted by hard manual labor. Indirectly the new method results in increased production of blackboard slate, for it is found that where sawn blocks are used the requirements as to quality are not as strict as demanded by the block-maker, and much stock of a quality formerly used for roofing slate is now diverted to the more profitable blackboard trade.

Blackboards in Strong Demand

The blackboard-slate branch of the industry has enjoyed prosperity during 1925. During the early part of the year unfilled orders were three to four months behind, but toward the end of the year delivery could be made in a very few days after orders were received. The superior quality of slate blackboards is gradually attaining wider recognition.

Improvements in the process of manufacturing structural slate are to be noted. One Vermont company has been using successfully for nearly a year a carborundum machine making ten cuts simultaneously.

The production of electrical slate has probably fallen below that of 1924. No branch of the industry is subjected to more keen competition from substitute materials.

The granule industry has been normal. Though slate surfaced composition roofing is very widely used, present plant capacity is more than sufficient to supply all granule needs.

The National Association Responsible for Improvements

Three years' activity of the National Slate Association under the direction of Secretary W. S. Hays, and of N. M. Male of Pen Argyl, Penn., as president during 1925, has led to very great improvements in the industry in methods of operation, co-operation in promoting the general interests of the commodity, in improved transportation and in extending the market through skilful advertising. The summer meeting of 1925 was held in the Pennsylvania slate district and the autumn meeting in the Vermont district.

The quarrying of slate is a complex problem. Under present practice the waste is tremendous. Much of the waste is due to inherent defects of the stone, and therefore is unavoidable, but there is a growing conviction that the percentage of recovery could be very greatly increased by improved practice. The interchange of ideas and observation of new methods is gradually promoting better practice, and pronounced improvements even of a radical nature may be expected. Slate meets with keen competition in every field. Nothing would more surely promote its wider use than reduced production costs, and the most promising field for reducing costs is in increasing the percentage of good slate as compared with the total quarry output. Therefore it is believed in some quarters that the problem of greatest moment at the present day is the development of quarry methods that will preserve the good slate and cut down the waste.

The establishment of better standards, both in materials and in workmanship, is an important function of the National Slate Association. In January, 1925, the Association issued a bulletin on "Standard Specifications for Floors, Walks and Terraces." The Association has also prepared a complete illustrated text book on slate roofing covering all details of construction and materials. This book now in press will embrace standard specifications for slate roofs of all kinds.

A noteworthy event was the organization on an active working basis of Committee D-16 of the American Society for Testing Materials. The movement toward establishing this committee was begun at Atlantic City in 1923. The committee now consists of a membership representing government bureaus and architects as well as consumers and producers of slate. Its function is to standardize terms, definitions, and testing methods; and to initiate research on fundamental properties. Much profitable study has already been devoted to the chemical, mineralogical and microscopic characters of slate.

The industry enters 1926 with a confident expectation of steady expansion.

Slate Industry Conferences

THE annual convention of American Slate Manufacturers will be held at the Hotel Commodore, New York City, on January 19 and 20, 1926.

The Tuesday morning sessions will be devoted to group meetings of the quarry and mill managers. Charles E. Gerstner will speak on "Better Co-operation with Slate Setters"; Mr. Fell will give the report of the slate roofers committee, and at the conclusion of the session the regular annual election of officers and directors for the coming year will be held. Immediately after the members will be the luncheon guests of the Hosts' Club and will be favored by an address from E. J. Cattell and many other entertaining features. The usual sessions of the Slate Roofing Contractors' Group, Slate Setting Contractors' Group, Slate Salesmen's Group, Hosts' Club Group, and Slate Distributors' Group will be held on the mornings of the convention.

The Tuesday afternoon session will consist of joint meetings of the various groups, and the general discussion on improved production methods is sure to be of interest to all the slate trade. In the evening, the annual dinner will be held, to be followed later by entertainment and a theater party.

The Wednesday sessions will be devoted entirely to meetings of the executive committees of the National Association and final committee meetings. On conclusion of these, there will be a luncheon for all quarry managers or others staying over. A trip has been arranged for the afternoon for all those interested in viewing the slate roof jobs throughout Long Island.

N. M. Male, the president of the National Slate Association, has written urging all members to attend. He says in part:

"Mr. Hays, of Philadelphia, secretary of the Association, has made elaborate plans for the convention and a successful meeting can be predicted."

"In addition to the usual social features, the National Slate Association has so arranged the program of the annual meeting as to undertake a line of research and investigation for the purpose of solving some problems which from time to time have perplexed the quarriers of slate products, as well as those interested in its distribution and proper installation."

"To be successful in our industry is what we desire. 'Success is not luck, nor pull, nor a soft snap, but the longest, steadiest, toughest job you ever tackled.'

"Study the advance program here given. Come prepared to take an active part in all discussions and give your industry what you owe her, your much-needed assistance and co-operation."

Magnesite Makes Much Technical Progress in 1925

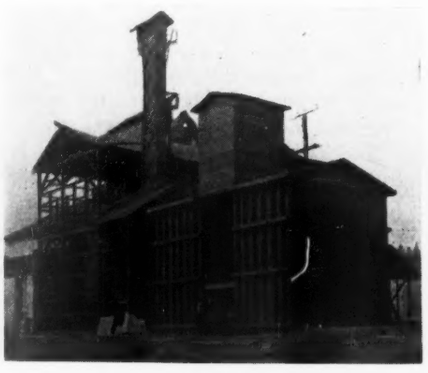
Manufacture of the Plastic Form Begun in the Northwest with a New Type of Furnace

BOTH production and use of magnesite increased in 1925. A part of the increased use, however, was taken up by additional importations. But a visit to plants on the Pacific Coast and talks with those informed in the industry leaves one with the impression that the industry is recovering slowly from the long period of depression that followed the war, that research is finding out ways of bettering magnesite products and decreasing costs and that the future of the industry appears brighter than at any time since the tremendous drop in production which came in 1921..

Adding Plastic Magnesite to Dead-Burned Production

The state of Washington has always been the largest producer of dead-burned magnesite and this year it has begun the manufacture of plastic magnesite. Two companies are engaged in it, one of which, the Northwest Magnesite Co., of Chewelah, Wash., is the largest producer of crude and dead-burned magnesite in the country. The other, the Spokane Plastic Magnesite Co., is an old company that has been making magnesite stucco and flooring for some years, but which did not calcine magnesite. This year it has erected a furnace of a new type which is calcining crude bought from the Northwest Magnesite Co.

The furnace was designed by R. D. Pike of San Francisco and it is a modification of the Herreschoff roasting furnace which has been used for many years in calcining copper ores to remove sulphur. It is of the multiple hearth type and in this particular furnace there are seven hearths placed one above the other and encased in a cylinder



New plant of the Northwest Plastic Magnesite Co.

so that from the outside it resembles a vertical lime kiln.

Each hearth is provided with a set of rabbles which turn upon a common central shaft. The rabbles (or rakes) work the magnesite to the outside on one hearth and to the inside on the hearth below. There are openings through which the magnesite passes from one hearth to another. These are on the outside on one hearth and on the inside on the hearth below.

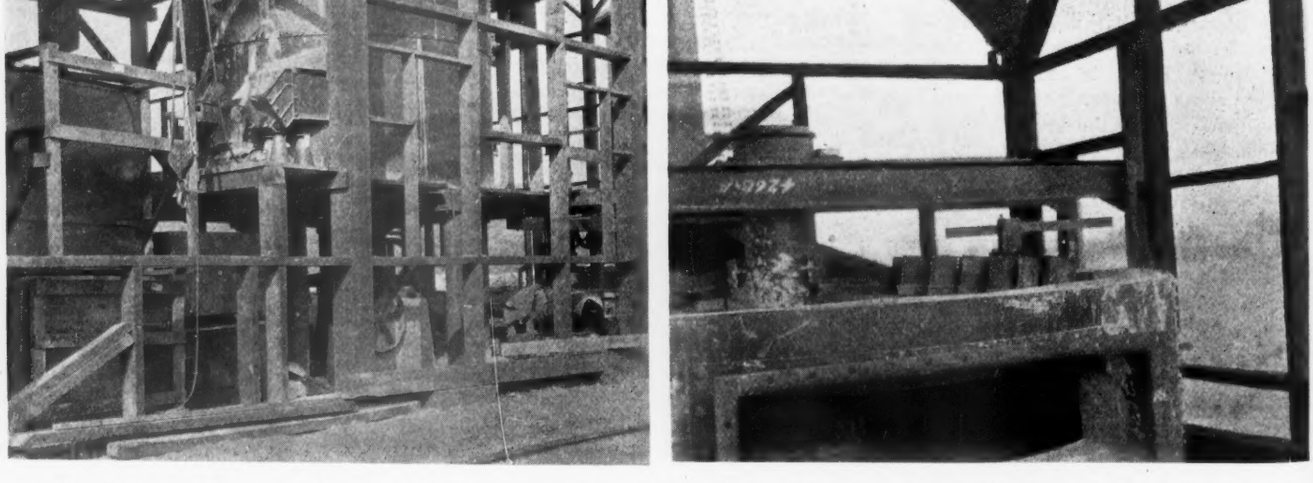
The rabbles are cooled by a current of air furnished by a fan, and those used on the two lower hearths are of a heat-resisting alloy called Hibnickle. These are the only hearths which are directly fired. Oil is used as fuel.

The magnesite is received at the plant already crushed to pass a 10-mesh screen.

The Northwest Magnesite Co. has also begun the production of caustic or plastic magnesite, using one of its rotary kilns for the purpose. This has been fitted with a combustion chamber in front of the kiln in order to regulate the heat more efficiently. Calcination of magnesite to the plastic form requires careful heat regulation to prevent dead-burning.

Experimental Work on the Use of Dolomite for Magnesite Cement

Experimental work has been carried on by G. A. Bole, of the Bureau of Mines Experimental station at Columbus, Ohio, in the production of magnesite cement from dolomite. The method employed is that of calcining at a constant pressure (say at one atmosphere). This definitely fixes the temperature at which the calcium carbonate in the dolomite is decomposed. The magnesium carbonate can be calcined at a lower temperature without affecting the calcium carbonate at all.



Left—Bottom of furnace showing where burners are attached. Right—The upper hearth showing half of rabble and the feeding bar. The hole below is for attachment to Cottrell precipitator

A Better Year for Phosphate Rock

Both Florida and Tennessee Fields Show Large Increases in Production with the Western Field Holding Its Own

By James A. Barr
Engineer, International Agricultural Corporation, Mount Pleasant, Tenn.

THE rather slack times that prevailed at the end of 1924 in Florida rapidly became better in the pebble field, during the early part of 1925. The heavy stocks of rock that had steadily accumulated at the mines, were soon depleted, especially the higher grades. Prices, which had been too low, also stiffened and as usual the demand jumped along with the increase. At the present writing there is little if any spot high-grade for sale. The stock piles of low-grade are now being drawn upon and the present rate of shipments exceed the production. The prices of low grades have been too low in comparison with the higher grades and foresighted buyers have taken advantage of the fact.

As was the case during 1924, very little tonnage of hard rock was shipped. Hard rock production costs are still too high for present day market prices. Hard rock is usually a high grade product and awaits higher prices or improved methods before it will become a factor in Florida production.

Methods of the "Pebble" Field in Florida

The methods of the pebble district only, will be discussed owing to the relative inactivity of the hard rock field.

In the removal of overburden, no new methods have been introduced or contemplated. The larger percentage of overburden is still stripped by hydraulic methods. Steam and electric draglines are used for the balance of overburden operations.

For the larger size draglines, under Florida conditions, the following facts stand out. Electric power gives a lower cost per yard as compared with steam due mainly to less operating delays. The long drawn out controversy between the relative merits of rheostatic control with alternating current for motorizing the dragline and the direct-current Ward-Leonard system, is now definitely decided in favor of the latter. The Ward-Leonard system advantages are, higher power factor, lower demand charge, better motor characteristics and less motor trouble.

The largest size dragline in the field, a 320-ton machine with a 150-ft. boom and a 6-yd. bucket, has been placed on caterpillars. The operation of the caterpillars has been very satisfactory. The conditions must be unusual to pay the overhead and maintenance charges on the additional investment of $30,000 to $35,000 for this type of mounting.

All of the phosphate matrix (bank run) is still handled by hydraulic methods, with no better ones in sight under present conditions. Water under 150 to 200 lb. pressure is directed against the bank, using monitors with 1½-in. to 2¼-in. nozzles. The back flow is pumped to washing plants by 10 or 12-in. motor-driven centrifugal pumps, discharging through as much as 3000 ft. of pipe line. As many as two or three booster pumps are placed in the line as required by the head. Cast iron pump shells of very heavy section are used. Manganese shells have been tried. Roller thrust bearings is an important item in the successful operation of the pump.

The Standard Washer

No important changes have been incorporated in the successful washers. Several unusual designs and flow sheets have been tried but were not considered successful. The standard washer now consists of the following:

(a) Rotary screen with 1¼ round holes to separate mud balls lime rock, etc.

(b) Log washers to elutriate the clay.

(c) Vibrating or shaker screens to separate the smaller silica grains, and to dewater.

The main problem in washing is to get a screen that will not blind. Two new forms of screens are being tried; one is a gyrating-shaking screen using bouncing rubber balls to jar the screen so as to prevent blinding and the other is a motor-vibrated type with piano wires for the screening surface. The space between the wires is 3/64 in. No results are available as yet. It must be remembered that a washer will have to handle as high as 1500 to 2000 tons of finished phosphate per 24 hr., which represents a total feed of three or four times that amount, from which the clay must be separated and also the silica screened out on 1/32 in. to 3/64 in. screens. The silica being of the same specific gravity and shape as the phosphate precludes practical gravity separation methods.

In the present washers, all of the soft or colloidal phosphate is lost in the tailing as well as the smaller particles of granular phosphate which pass the final screen along with the silica. Improved screening methods have decreased the latter loss but there is still room for improvement.

Research for Heat Method

Research work is now being carried on by several companies with a view to improvement in the recovery of fine granular phosphate and the characteristics of the colloidal phosphate are being investigated.

A successful furnace method which would admit the taking of the bank run direct to the furnace for the volatilization of phosphorus, would solve the above problems in one stroke, but to date nothing has been brought out that will stand competition with present methods. At least three companies are experimenting along these lines and the Bureau of Soils, Department of Agriculture, is investigating low temperature volatilization methods.

In investigating heat reduction methods it must be remembered that electric energy is too valuable as power to compete with coke or fuel as a source of heat. Furthermore in heat processes coke or other fuel must compete with sulphuric acid as used as a reduction agent in the present well established methods. Sulphuric acid is often a by-product with future possibilities of a stable price. These remarks, of course, are not applicable to the production of phosphoric acid of U.S.P. quality for food and medical chemicals.

In drying of phosphate as it comes from the washer with 14% to 16% moisture, nothing new has been brought forward during the year to take the place of the present direct-heat, oil-fired rotary dryers. The increased price of fuel oil is turning the attention of the operators to the possibilities of powdered coal. A unit type coal pulverizer is being tried out in one drying plant. Another company is preparing to investigate the subject of different type burners of the mechanical atomizing type as well as different designs of dryers. To provide a uniform feed to the dryers a calibrated nozzle was developed in the latter part of 1924 and put into successful operation during 1925. Since the phosphate is free flowing, it was a simple matter to adapt an orifice for the regulation of the stream of rock coming from a storage bin.

Public utility companies, with plants located at tidewater are extending transmission lines through the phosphate fields and the following year will see increased use of central station power. Fuel oil will advance again in 1926 so that powdered coal then can compete, especially in a new station.

A plant for the manufacture of phosphoric acid was put into operation at South Tampa during the spring of the year. The

Dorr counter-current method is used to treat a low-grade phosphate rock. The resulting phosphoric acid is evaporated to 30 deg. Be. and used to acidulate a further quantity of higher grade phosphate, a 45% to 48% triple super is being shipped.

The well advertised Florida land boom has seriously affected the labor supply as well as increased material and supply costs. The congestion of railroad traffic has also been very troublesome.

The Tennessee Field

During the early part of the year in Tennessee shipments lagged, storage piles were enlarged and several plants were shut down, but later on the demand increased until at the present writing practically all of the mines and plants are operating. There will be the usual slacking up during the holidays but everything points to a good new year.

A considerable increase in the demand for raw ground phosphate all during the year has kept the two principal producers operating at capacity.

Hoover and Mason Phosphate Co. is engaged in very active research and small scale testing of furnace methods for the volatilization of phosphorus direct from the raw rock. The results are said to be encouraging and perhaps a larger furnace will be built.

The International Agricultural Corp., has completed the installation of a 60-ft. Dorr thickener, followed by Allen Cones, for the recovery and washing of 60 to 200-mesh phosphate sand which were formerly sent to the tailing ponds. The recovery and product are exceeding expectations. The thickener is used as a hydro-separator to float off the clay and the Allen Cones take the underflow for further washing, classification, and dewatering.

The crushing and screening plant for the production of poultry grit built during 1924 by the International Agriculture Corp. is being enlarged.

The Charleston Mining Co. have installed additional concentrating tables for treating their phosphate sands from the main washer. They are also actively engaged in research work on improvement of grades and higher recoveries.

The Rockdale Iron Works, producers of ferro-phosphorus, have entirely rebuilt and enlarged their blast furnace plant at Rockdale Tennessee. This company is an important consumer of high-grade lump phosphate rock.

The larger part of the output from the mines in the Western field is used locally to produce phosphoric acid and triple superphosphate, as represented by the operations of the Anaconda Copper Mining Co. The mines of this company are shipping at the rate of 200 tons per day to Anaconda. Here the modified Dorr counter current decantation method is used. Sulphuric acid for the process is secured as a byproduct from the roasting of high sulphur concentrates. The triple superphosphate of 45% to 48% grade, after drying and grinding, is shipped in bags or bulk. The plant is of modern steel construction, well laid out as a result of extensive preliminary work in a pilot plant.

Other companies are mining small tonnages or shipping from accumulated stock piles. The high freight rates to consuming centers nearer to Florida and Tennessee is preventing further expansion in the shipments of raw rock.

Since the disposition of Muscle Shoals is again before Congress in the shape of two reports from the same committee we hope that the subject will be finally settled. The past treatment and methods of handling represent a bewildering circle. The farmer wants cheaper fertilizer, the politician wants more votes, the guardians of the governmental property want full value for same and the common people and the taxpayer who sometimes rise up with a surprising vote, object to footing the bills of most schemes as proposed. At the bottom of most of the schemes for a foundation lies governmental subsidy cunningly concealed or made pleasant to look at. As to governmental operation, we might turn to such paternal interest in Western reclamation projects which not only have resulted in some deficits but in dissatisfied farmers.

Unless the Shoals properties are sold or rented on a fair valuation basis then it must follow what amounts to a practical subsidy and consequent unfair competition with present private operation, which could be carried so far as to amount to practical confiscation. The farmer always prospers along with the fertilizer companies and there is no reason why they should not get along profitably together without governmental operations and higher taxes.

The Trend of the Phosphate Industry

Results of Rock Products Own Investigations and the Effect of New Treatment Methods

THE phosphate rock industry has had a much better year in 1925 than in 1924 or 1923. It has a long way to go before it will reach the production peak of war times and the short period of high prices that followed the war. On the other hand, the industry is on a much firmer basis than during the boom period referred to. Costs have been cut and better production methods installed, and while the increase in the demand for phosphate rock is slow it is steady, and the promise for the future is for a market that will continue firm, even though the price does not reach war-time level for many years.

The price held fairly level throughout the year, but there was a slight downward tendency in some grades during the last months which may be considered as offset by a good rise in other grades.

The principal production of 1925 as in other years came from Florida. Recently a ROCK PRODUCTS representative visited all the plants in Florida and found prospects encouraging. In the land pebble district, of the 13 principal producing companies, eight were operating and it was expected that some of the remaining five would resume production soon. In the hard rock field only two plants were operating, all of the production going to European ports. The soft phosphate industry showed very little activity. While this may seem to indicate no more than that a considerable portion of the Florida field is still non-producing, it must be remembered that conditions were worse a year ago when some of the plants now operating were not producing at all.

Tennessee is the second state in phosphate rock production and the latest reports received from this state were to the effect that all the principal companies were producing steadily. The ground rock business in which the slump was about as marked as in any part of the phosphate industry seems to have gone further toward recovery than some of the other branches. There has been a great reduction of costs in this field, not only by cutting down overhead and employing only what labor is necessary to the operation of the plant and pit, but by improving plant methods and putting in labor-saving machinery where it would pay to do so. While none of the Tennessee operations is making a great deal of money, all of them are "making a living" and some of them are doing better than that.

No recent reports have been received from Idaho and other Western states in which phosphate rock is produced, but the latest available information is to the effect that there has been little change in this field.

If actual production has not yet shown the advance that the friends of the industry would like to see, the technical progress has been good. There is no doubt but what the whole phosphate industry, from the rock in the field to the finished fertilizer that goes on the land is moving to some change. The element which it is desired to add to the soil is phosphorus in a form that plant life can use. Hitherto it has been shipped to the consumer in combination with so many other things, all of which may be desirable but none of which contains phosphorous, that freight has been a very large part of the cost at the point of use. Hence the tendency is to use higher concentrations

of phosphorus,or phosphoric acid, and to leave the diluting which is necessary before it can be applied to the soil to be done locally.

At present the making of higher concentrations of phosphoric acid is mainly accomplished in the wet way and very complete methods have been worked out. Some good sized plants for the wet method have been put up in the past year. What is almost the standard method now employs Dorr thickeners and counter-current decantation. In this method the solutions of phosphoric acid move in one direction through the series of thickeners while the finely ground rock from which the acid is being extracted moves in the other. The acid solution is used to treat raw phosphate rock of good grade to make what is known on the market as "triple superphosphate" because it has approximately three times the phosphoric acid content of the ordinary commercial superphosphate.

Utilizing the Gypsum Waste

A by-product of the wet method of extracting phosphoric acid in the wet way is gypsum, in the form known to the trade as "synthetic" gypsum. Up to the present year this synthetic gypsum was of little value because no one knew how to make a satisfactory plaster out of it. But the Rumford Chemical Co. of Providence, R. I., found a way to neutralize and treat this gypsum so as to make a good plaster and is now manufacturing it into gypsum blocks at the rate of 30 tons per day. Another company has purchased the right to use the process, which is covered by patents, and will start production soon after the first of the year.

The method, as explained elsewhere, consitss in neutralizing the acid solutions with an alkaline carbonate and then centrifuging. The centrifuging not only cleans the crystals but induces the form of crystallization known as "twinning," and this has an excellent effect on the physical characteristics of the plaster.

It is quite evident that if the gypsum waste from phosphoric acid making can be turned into a profit instead of a source of considerable expense (for disposal) there is an opportunity to put higher concentrations of phosphoric acid on the market at a lower figure than they can be sold at today.

The Heat Method

The other method of treating phosphate rock to produce phosphoric acid is the heat method. The rock when heated to the right temperature in a reducing atmosphere gives off its phosphoric content as elemental phosphorus. This burns as soon as it comes in contact with air, forming phosphoric acid, in which form it is precipitated and collected. The heat process is not yet out of the experimental stage. The United States Government through the Bureau of Mines has done a great deal of experimenting with it and the process has been further developed by two or three of the large companies which are either producers of phosphate rock or interested in the manufacture of phosphate products.

Advantages of Heat Treatment

The advantages of heat treatment are those of a somewhat lower cost and the possibility of using lower grades of phosphate rock. The latter advantage appeals particularly to the phosphate rock producer who for many years has been forced to market only his highest grade material while he saw a very large percentage of the phosphoric acid in the deposit either left behind in the field as "throw-backs" or sent to the waste pond of the washery. The amount of phosphorus lost each year in such waste is enormous, but the producer has not thought much about it because of the impossibility, with known methods, of turning this waste into a marketable product.

Besides the two processes for extracting phosphorus which have been mentioned, there are others which promise much and some of which have advanced to the commercial plant stage. But a discussion of these, and indeed of the trend toward higher concentrations, hardly belongs in a review of the present state of the phosphate rock producing industry and they are only mentioned because of the influence they are bound to exert on future production.

A method of producing a higher grade product which is, in a way, a part of the tendency toward higher concentrations, is that of "concentrating" the raw rock on tables or by some similar method. This has been well worked out at the Charleston plant at Mount Pleasant, Tenn., and other companies are doing experimental work along the same lines.

Foreign Production

A feature of the phosphate industry about which little has appeared, but which is apparently having a powerful effect on the American production, is the increasing production from other countries. A significant report comes from the McLanahan-Stone Machine Co. of Hollidaysburg, Penn. This company has just sold its third order to a British company operating on Christmas Island, for two dryers and a steam engine. The Morocco production increased largely in 1925 and an estimate from a reliable source is that it will pass 500,000 tons this year.

The demand for phosphate rock to be made into other products than fertilizers has been excellent. The use of low grade pebble phosphate for concrete aggregate, which was mentioned last year in the annual review of the industry is said to have increased along with the demand for all building materials in Florida. It is said on good authority that pebble phosphate was actually sold, at one time, for gravel for construction purposes at a higher price than it would bring as phosphate rock. That this can no longer be done is indication of a healthier state of the industry.

Vermont Talc Industry Has Good Year

VERMONT talc producers on the whole had what might be termed a satisfactory year. While the demand did not nearly equal the total productive capacity of the mills, the producers have been able to maintain a firm price in the talc market. Although New York and Vermont are the largest producers of talc in the country, in fact each produces more than the combined total of all the other states (omitting the production of the other), they are not in competition with one another, for the talc from these two localities differs radically in grade and finds different uses. The Vermont grade meets the requirements of certain industries and being cheaper than the New York talc finds preference in those markets. That produced in New York is whiter and of different texture and is favored in spite of higher price for other industries where these properties are essential.

The talc business in Vermont has suffered through competition of substitutes of other cheaper materials that seem to do as well in several industries which formerly used a large amount of talc. While the uses of talc appear to be increasing in variety and purpose, there are very few users of carload volume, and this is an essential to the maintenance of the business. Probably the entire output of Vermont is produced by two companies, one of which supplies 75% of this and operates three good sized plants.

The talc output will be materially increased when new uses for the material are sufficient to demand greater tonnage. The outlook for 1926 sems at least as good as 1925 and depends entirely on whether the production keeps close to consumptive demands.

Bureau of Mines Work on Oil Shales

WHEN attention was called to the vast deposits of oil shale in Colorado and adjacent states and their value as potential sources of motor fuel, the U. S. Bureau of Mines began investigating the composition of these shales and the recovery of gasoline and other products from them. The bureau has studied the types of retorts used in Scotland and other countries where oil shales have been worked, has made many small-scale tests and has accumulated a large mass of data bearing on temperatures, rate of distillation and other factors that determine the yield and quality of the products. Congress in 1925 made an appropriation for the construction of a pilot distillation plant to be operated by the bureau. A site for this plant has been surveyed in Colorado and plans for the layout of the plant and specifications for the necessary equipment are being prepared.

New Enterprises in 1925

SOME idea of the activity in the rock products industries in 1925 may be gained from the following summary of new incorporation notices published during the year. It is doubtful if this is complete; and of course many projects are inactive; but the table shows faith in the future of these industries, if nothing more.

NEW CAPITAL INVESTED IN ROCK PRODUCTS INDUSTRIES IN 1925

Industry	Number of new incorporations	Incorporated capital
Cement	30	$105,200,000
Lime	28	10,588,000
Sand and gravel	235	19,060,500
Crushed stone	69	20,202,000
Limestone	14	1,484,500
Marble	6	1,250,000
Granite	9	780,000
Mica	7	3,950,000
Talc and soapstone	4	500,000
Slate	7	510,000
Feldspar	5	690,000
Bauxite and asbestos	2	105,000
Rock asphalt	15	17,534,000
Potash	2	260,000
Graphite	2	100,000
Gypsum	11	15,573,000
Magnesite	2	50,000
Cement products	157	11,487,000
Miscellaneous	26	650,000
Miscellaneous (no capital value reported)	39	
Total	670	$209,974,000

Dixie Portland to Install Two Kilns

THE Dixie Portland Cement Co., Chattanooga, Tenn., is planning to install two large new kilns at its plant at Richard City, Tenn., These kilns will be among the largest in the country.

New Cement Plant Proposed for Ocala

PLANS for the organization of the Ocala Portland Cement Co. are said to be completed and to call for the erection of a 1,000,000-bbl. plant at Marion county, Fla. The project is said to be financed by Northern and Southern capital without open sale of stock. W. B. Elcock of Atlanta, Ga.: F. H. Logan, Lee Miller and Joseph Bell of Ocala, are said to be interested in the establishment. D. S. Mosson, assistant state geologist, is said to have been engaged in investigational work for several months on the advisability of establishing such a plant at the locality.

The plant and limestone quarries will be located between Sparr and Lowell, about 12 miles from Ocala.

The new plant will cost about $2,500,000 and F. L. Smidth and Co. of New York are said to have the contract for the engineering work.

Old Mission Portland Cement Company to Expand

IN his annual report to the stockholders of the Old Mission Portland Cement Co., San Francisco, Calif., William F. Humphrey, president, reported a healthy growth, as evidenced by increased sales and production compared with 1924 and emphasized the fact that the outlook for the cement industry for 1926 was generally good.

Commenting upon the affairs of the company during the year, he said that the capacity of the company's mill at San Juan Bautista, is taxed to the limit, adding that the company expended $250,000 last year for improvements and extensions, while $750,000 additional will be expended during 1926 to increase the plant capacity to approximately 1,500,000 bbl. a year, a program decided upon at the last annual meeting.

Herbert Fleishhacker, San Francisco banker, was elected to fill a vacancy in the directorate of the Old Mission Portland Cement Co.

There were no other changes in the board and the outgoing officers, headed by William F. Humphrey, president and general counsel, and J. A. McCarthy, vice-president and general manager, were re-elected.—*San Francisco (Calif.) Chronicle.*

Plan New Alabama Cement Plant

CHARLES L. HALL of Chattanooga, Tenn., with associates, is said to be planning the erection of a $3,500,000 portland cement plant at St. Stephens, 60 miles from Mobile, Ala., on the Tombigbee river. The new plant, which is expected to be completed and in operation by the fall of 1926, is to have a capacity of 4500 bbls. per day. The name of the new organization will be Santa Rosa Portland Cement Co., and a warehouse for quick service will be maintained in Mobile, Tampa, and New York. Complete design and construction of plant is in the hands of the H. K. Ferguson Co. of Cleveland, Birmingham, and New York, with Ellis Soper of New York as consulting engineer. The board of directors has not yet been announced, but is said to include Charles L. Hall, president, Hermitage Portland Cement Co. of Nashville, Tenn., and other prominent business men of the South.

Monolith Company Purchases Title Outright to Holdings

ACCORDING to a grant deed filed recently in the Kern county hall of records, the Monolith Portland Cement Co., Los Angeles, Calif., has purchased outright for a reported cash consideration of $450,000, the site and lands on which the Monolith plant is located.

Mayor Cryer of Los Angeles signed the deed of sale, completing a deal that gives to the Monolith interests full title to lands purchased by the city of Los Angeles in 1907, 1908, and 1911, on which was erected the cement plant that furnished concrete for the Los Angeles aqueduct.

Upon the completion of the Los Angeles aqueduct, the Monolith Portland Cement Co. is said to have obtained leases on the property for manufacturing cement under private enterprise.

In the past few years the real wealth of the land surrounding the manufacturing plant in high-grade cement clays became known, and a strenuous campaign was entered into by backers of the Monolith plant to obtain full title to the enterprise. This fall, tracts of cement land were obtained under a 100-year lease from the Jameson interests (see ROCK PRODUCTS, November 14, p. 73, for details) and the present deal has given the Monolith Portland Cement Co. practically full title to the lands east of Tehachapi at the mouth of the gorge leading to the Mojave desert.—*Los Angeles (Calif.) Times.*

Adam L. Beck to Build Cement Plant at Buffalo

IT is reported that Adam L. Beck, formerly president of the Indiana Portland Cement Co., Greencastle, Ind., which was sold last June (see June 27 issue) to the International Cement Co., New York City, will build a new plant at Buffalo, N. Y. Mr. Beck also promoted and built the Oklahoma Portland Cement Co. at Ada, Okla.

W. C. Ross Appointed District Engineer at Birmingham

W. C. ROSS, lately field engineer in Florida for the Portland Cement Association, with headquarters in Tampa, has been appointed district engineer in charge of the Birmingham office to succeed J. R. Fairman, who was promoted to assistant general manager in charge of the Southeastern territory. Mr. Ross joined the forces of the association in 1924. He attended Vanderbilt University and prior to the war was assistant city engineer of Little Rock and then assistant state highway engineer of Arkansas. During the war he was a captain of engineers. Afterwards he engaged in the private practice of engineering in Arkansas. Mr. Ross has had extensive experience in railway, bridge and highway construction. His appointment was effective December 10.

Bids To Be Received for Hanover Cement and Stone Company

A MEETING of the bondholders of the Hanover Cement and Stone Co., Ltd., of Hanover, Ont., will soon be held in Toronto to deal with tenders for the industry which will be received by the executors, the Chartered Trust and Executor Co., 46 King street, W., Toronto, until December 19. The property at Hanover consists of five acres with the necessary factory buildings and kilns for the manufacture of portland cement. A foundry located in Hanover is also owned by the company as well as extensive clay beds about a mile from the town and water power rights on the Sangeen river with two power houses, one at Hanover and one at Maple Hill, Ont.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Cement Products Closes Profitable Year and Constructive Five-Year Period

More Than 600,000,000 Block Are Now Made Annually and the Use of Other Products Is Increasing Rapidly

THE last five years, and particularly the last twelve months have brought out much of particular significance to the cement products industry. Markets have expanded. Production has increased. Much study has been given to manufacturing efficiency and to standardization of the various products and the methods of their use. The strategy of the next twelve months, leaders say, must be directed largely to holding and consolidating recently acquired markets. It is not expected that the year ahead will see the establishment of any great number of new factories, but rather that the rapid transition now in process from hand operation to power-driven machinery, both for casting and conveying purposes, will continue at increased rate.

Cement Building Products

If the 6000 cement block manufacturers of the United States had been divided into two classes five years ago the first class, well equipped and prosperous, would have numbered only some 300 concerns. The remaining 5700 occupied more or less uncertain positions down the business scale. At present a similar division would show 1500 factories with modern machinery of more advanced type than any in use five years ago, save in a handful of plants. The latest types of block and tile machines are capable of doing 30 times the work of the prevailing hand machine of five years ago—and of course they do it more economically, more uniformly and with less likelihood of interruption.

One of the substantial and beautiful designs of lamp standards recently brought out

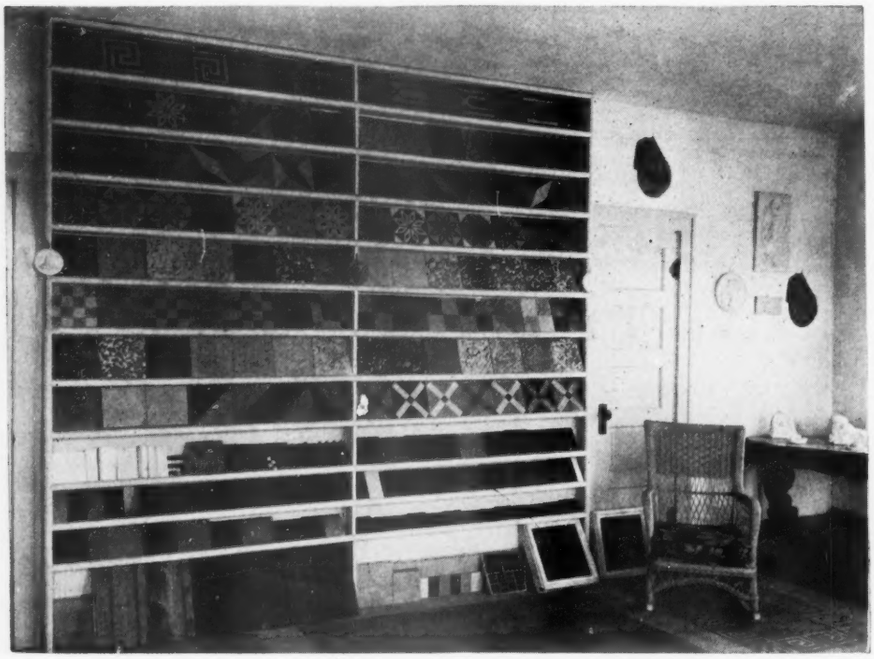
The movement for the improvement of manufacturing equipment has already gotten into almost every community and is now greatly affecting competitive market conditions. The manufacturer who has been operating under antiquated conditions is finding that he must keep up with the times or go out of business. His factory has got to be efficiently equipped and operated in order to compete, for an efficiency competition is really on in the concrete products industry.

Hundreds of manufacturers are having their products tested at close intervals. A year or two ago only a few followed this practice with any regularity. Many advertise quality regularly, and some have a guarantee of quality printed on every letterhead and billhead. These are substantial improvements over the slip-shod and haphazard methods of a few years ago. Over $4,000,000 worth of modern block and tile machinery and mixers were purchased by cement products factories in 1925.

The volume of cement block and tile sales have increased over last year's. The present estimated annual production is very large—equal to 605,000,000 standard block. It can-

Left—The Chicago stadium, which will contain more than $1,000,000 worth of concrete cast stone when completed. Right—A close-up of one of the wings of the stadium. Everything shown is made of concrete

not be maintained unless quality and service are constantly in mind. Shortage of competing materials, high powered sales efforts and artificial stimulation of one sort or another may get business but nothing short of real quality, and thorough satisfaction with both material and service will hold the market.



An exhibition of Spanish floor tile by a progressive southern manufacturer

The following are among the outstanding achievements in the cement block and building tile field during the last five years:

An exhaustive series of fire tests completed at the Underwriters' Laboratories proved conclusively the fire resistive merits of cement masonry. Copies of these tests were furnished to all insurance commissions, rating organizations, members of the National Fire Protection Association and hundreds of others interested.

Insurance rating bureaus in a number of states have already granted residential structures of cement masonry the same rate as enjoyed by buildings with solid brick walls. Bureaus operating in 25 additional states now have the matter under advisement.

Through co-operation with the Division of Simplified Practice, United States Department of Commerce, various interests in the cement masonry field agreed to standardize on the size of cement building units—block, tile and brick. Over 90% of the production is now being made in these standard sizes.

The Building Code Committee of the United States Department of Commerce, in recommendations for building code sections covering dwelling houses, have recommended very favorably the use of concrete masonry for such purposes. More than 100 city building codes now admit cement masonry under the standard specification requirements of the American Concrete Institute.

British government stability tests on walls of monolithic concrete, cement block and clay brick masonry, just recently made public, show conclusively that monolithic concrete and cement block walls resist approximately twice the side thrust required to upset comparable clay brick walls of same thickness.

About 30 local cement products associations exist in the industry from New England to California. There are also five active state organizations. These have a nominal combined membership of over 1200 members.

Cinder aggregate cement blocks have been introduced and are being successfully manufactured in over 100 factories and marketed in 300 cities. Cinder partition tile are being marketed in 100 cities. Haydite (puffed burnt clay) aggregate is being used in the manufacture of block in two cities, coke breeze for block and tile in one city and blast furnace slag for tile and brick in one city.

Two hundred factories have received the Concrete Products Association certificate of quality, a guarantee to users that block, brick or tile meets building code requirements and standards of the American Concrete Institute. Many additional plants test products regularly and cover all products with their own guarantee. Five years ago practically no commercial testing was done or guarantees furnished.

Clumsy and irregular pallets of wood are being relegated rapidly for cast iron ,and lately punched steel pallets.

During the past season stock piles in the block and building tile field have been noticeably larger, indicating more ample manufacturing facilities, larger sales volume, better credit conditions, improved curing methods and ability to give better service and handle larger orders. The stock pile is an excellent barometer.

In the field of cement masonry houses, which constitutes one of the leading uses for block and tile, the market has improved steadily. The Portland Cement Association reports sales of house plans in 1925 nearly equal to the 1923 and 1924 sales combined.

Concrete brick has just come through a hot controversy with its erstwhile comfortable old rival clay brick, and wrested from the latter its heretofore exclusive ownership of the word "brick." Concrete brick are sure enough brick, according to the tests made at Columbia University, United States Bureau of Standards, Lewis Institute and elsewhere, not only indicating their stable quality but showing the much better bonding ability than that of the clay units. Concrete brick has attained an annual output of approximately 300,000,000—almost every sale being made in the face of intense competition from well intrenched manufacturers of clay units. Concrete brick, however, are winning strictly on merit. New markets are being developed at a modest rate.

Roofing Tile

Cement roofing tile has experienced most encouraging development during the last five years probably more than during the preceding two or three decades. Large size tile, now used extensively for the roofs of public, semi-public and industrial buildings, have long since passed the experimental stage and for the last five years have held the confidence of leading architects and engineers. They are now specified on many classes of buildings to the exclusion of other materials. For large mill and factory structures, railway terminals and stations, cement roofing of this type has come into general use.

An unusual cement product, water barrels for railroad bridges

The manufacture remains in the hands of a few large concerns having ample finance and experienced personnel, with factories located at advantageous points. As handled today, small capital cannot compete in the market for large type tile on a basis of either quality or cost.

Small or home type cement roofing tile have gone through an interesting cycle of development in the five years now drawing

to a close. For many years good quality tile have been supplied for residential and other work and roofs in good condition after 20 years' service may be found in several localities. Recent redesign has cut down weights, producing tile which may be laid over lighter framing. Automatic machinery has simplified production problems in the larger markets, a single automatic machine having a capacity equal to 10 hand machines. Improved methods of handling color and of curing are producing dependable surfaces. Ten factories are equipped with automatic machinery, some of these covering a radius

Concrete state line post on railroad. Cheaper to maintain than wooden post

of 100 miles or more but all of them cultivating intensely the territory immediately surrounding the factories. Over 100 smaller factories are using hand operated equipment.

During the last two years cement roofing tile have been furnished in six regular types of which French, Spanish, Shingle and Mission are the most popular. Five to ten standard colors are usually available in stock, with more than 100 shades and numerous variegated colors are supplied as required. The output of the small tile in the principal centers of the United States is reliably estimated at 40,000 squares, divided about as follows: Chicago, 20,000; Pittsburgh, 6000; Denver, 4000; New York, 3000; Cleveland, 3000; Los Angeles, 3000; St. Paul, 1500; Miami, 1500; Detroit, 1000; Dallas, 1000; Knoxville, 1000; Rochester, 300; Buffalo, 300; scattering, 6000.

Floor Tile

Cement floor tile, wainscoting, thresholds, stairs and other interior trim for buildings have had a favorable year as regards volume of business. Technical development has been carried to a high point by the better manufacturers but there is still a wide variation in the quality of material being supplied. Good material of this class requires the employment of scientific methods applied with unvarying exactness.

The leading product in this field is known variously as precast terrazzo and art marble, being finished with highly polished terrazzo surfaces. In a few markets, including Chicago, material of this kind is now being specified in preference to natural marble, the total volume of this business in 1925 in Chicago alone exceeding $1,500,000. The outstanding technical development in this field is the perfection of grading and curing methods with consequent elimination of checking.

Spanish floor tile which has reached a high stage of development in Europe and in Central and South America, is being successfully manufactured in a few cities in the United States. Preference for cement tile in Spanish patterns has given it tremendous markets in Mexico City, Havana, Buenos Aires, Montevideo and other cities of Latin America. A technical study of this product is now under way by the Portland Cement Association, and there is an encouraging outlook particularly in the Gulf Coast and Florida cities, Texas, Southern California and in other localities where Spanish architectural influences have taken hold.

Non-skid tile, surfaced with special abrasive aggrgeates, are finding a ready market in practically all of the larger American cities. These tile are in great demand for use in public concourses, ramps, under revolving doors and in areas facing elevators.

Cast Stone

The cast stone industry has made steady progress. At the present time 20 plants are producing cut cast stone by the sand mold process, covering all of the larger Eastern markets. Today the leading architects of New York, Boston, Philadelphia and Chicago specify this material for work of the finest character, occasionally at a premium over natural stone. The outstanding current award to this class of material is the Chicago stadium, the second section of which is now under construction. More than a million dollars worth of cast stone is going into this job.

Trueness of shape and interlocking nailless feature make concrete roofing tile quick to lay and able to withstand movements of the roof framing without breaking

Approximately 100 manufacturers are producing dry tamped cement stone carrying a heavy veneer of facing mixture with backing of ordinary concrete. This product, which ordinarily receives only molded and etched surfaces, which are not tooled, is in great demand for a wide variety of purposes. Good textures and colors require expert handling and while the recent strides made in the sale of this material reflect marked improvement in quality, there is still further opportunity in the same direction among some of the smaller operators.

Cement Pipe and Conduits

Cement sewer pipe is making steady headway in most of the leading pipe markets of the country. The rigid inspection of its member plants maintained by the American Concrete Pipe Association and the general admittance of cement pipe in practically all specifications are outstanding achievements during the past year or two.

The basic condition responsible for both technical and sales progress is the entrance into the pipe business of well financed and well managed companies in the field to stay. Today the sewer pipe business has progressed to a point where only such concerns can handle it on a satisfactory and profitable basis.

In the culvert pipe field the most outstanding evidence of progress is the completion of the report of the joint culvert committee, with specifications. This committee, representing all of the leading engineering organizations, has completed exhaustive investigations and tests, over a period of several years at a cost of many thousands of dollars.

Drain tile business has been poor during the past year as in several previous years, due to adverse agricultural conditions. Very little technical or scientific progress has been made, due to an almost entire lack of interest in drainage by the public. The best that can be hoped is that this business will regain normal proportions within the

next four or five years.

Irrigation pipe business has been below the average for the second or third consecutive year. Conditions are comparable with those in the drainage field. Cement pipe receives as large if not a larger proportion than formerly of the business offered, but the total volume has been shrinking appreciably.

Great interest is being shown and an increased demand has developed for cement electrical conduits. Extensive investigation indicates the remarkable adaptability of precast cement conduit as compared with competing types. During the past two years, the Commonwealth Edison Co. (Chicago) has laid some 3,000,000 duct ft., bringing the entire use of this material by that company to over 20,000,000 duct ft. or approximately 4000 duct miles.

Cement catch basin and manhole blocks are now recognized as the standard material for these purposes in a number of the largest markets. These block, which are made solid, are given sufficient curvature so that they may be conveniently laid with seven, eight or nine blocks in the circumference. Perpendicular and horizontal joints are tongued and grooved. Catch basins and manholes are laid considerably quicker and more economically of this material than of clay brick, and the completed work is superior with respect to strength and watertightness. The annual output of these blocks in Chicago and its suburbs alone has grown to approximately 3,000,000 units.

Concrete telegraph poles in Hackensack meadows, New Jersey, chosen for permanence because they have to meet unusually severe conditions

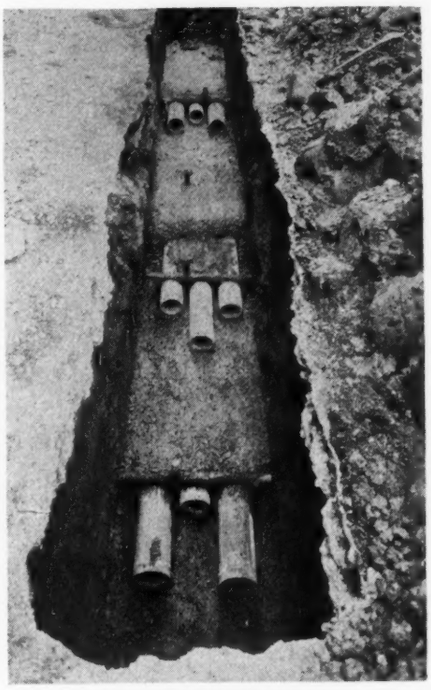
Posts and Poles

The most spectacular development in the pole field has been made with respect to cement lighting standards. Five years ago the cast iron standard was at the height of its popularity, with cement a poor second, because of cases of disintegrating posts, clumsy design or unattractive surfaces. During the intervening period some 15 or 20 large and trustworthy manufacturers have entered the field. New designs have been perfected which placed reinforcing far enough from surfaces to prevent rusting and spalling. Post sections have been perfected to withstand ordinary shocks. Advanced methods of manufacture have been introduced, including "spinning," vibrating and jigging. Careful curing, etching and surface finishing have taken the place of backyard methods. New types and styles have been introduced which make the cement lighting standard a decidedly attractive and dignified street ornament rather than a purely utilitarian contrivance and they have all but eliminated the problem of pole maintenance. These developments fully explain the present predominance of concrete in the lighting standard market.

The recent extensive use of concrete poles by British and European railway and power companies has attracted much attention in America, and at the present time a great deal of study is being given to the possibilities of more extensively employing precast transmission, telegraph or telephone poles, signal standards and trolley poles. The Pennsylvania railroad has a noteworthy installation of large feeder poles on its New York City electrification; street railways in a dozen cities are using concrete poles extensively for trolley wire support. Attractive precast concrete sectional arches are being employed exclusively on the Detroit, Toledo and Ironton railroad for trolley wire support in its electrification and this example will probably lead to further use of precast arches as substitutes for poles and spans.

The largest quantity users of fence posts continue to be the railroads. Several thousand miles of posts were manufactured by the larger roads during the past year, this increased use reflecting the greater serviceability obtained from recent installations as compared with those of a few years ago. It is more of a trick to make first-class fence posts than was first recognized, particularly when the size and weight have to be limited. Some of the earlier installations were not entirely satisfactory, but consequent study and experiment, the results of which have recently become available, have taken the uncertainties out of fence post manufacture.

It is significant that cement products manufacturers have never been able to market fence posts in any considerable volume or with profit enough to make the business interesting. Consequently, cement products factories carry fence posts mostly as an accommodation, and by far the greater volume of those used on the farms are made up by farmers themselves.



Concrete electrical conduit laid in monolithic concrete, of which 3,000,000 ft. were laid in Chicago recently

After a study of initial cost and maintenance problems extending over several years, the United States Postoffice Department has adopted concrete posts almost exclusively for mail boxes. Further studies are being made with several types of posts and boxes for rural route use. Postal and rural boxes now take over 50,000 concrete posts annually.

The Association of State Highway Officials, co-operating with the United States Bureau of Public Roads, has recently adopted a set of standard highway marker designs, for use throughout national, state, county and other highway systems throughout the country. Signboards to take the new designs and posts to carry them have been designed in concrete by the Portland Cement Association and are now being offered by cement products manufacturers. These new posts are very nearly maintenance-proof and carry replaceable and bucketshot-proof sign boards.

Accessory and Ornamental Products

The concrete laundry tray continues to hold the greater portion of the stationary

tub business in the cities of the country. Competing types concede inability to break into the market except in an incidental way. While the volume of shipments from the various factories is satisfactory, prevailing price levels have been too low to yield fair returns, according to current comment in the various communities.

Precast septic tank trade, which has been developed very extensively by two Indianapolis concerns, shows a very good increase. One of these concerns reports 7000 tanks shipped as against under 5000 last year. The increase is due to the development of popular feeling against the cesspool and reflects the rising tide of farm prosperity with increased demand for water and toilet facilities in rural homes. Active campaigns by several state health departments have been large factors in increasing the demand. One of the largest, if not the largest, installations of septic tanks in any one neighborhood consist of 400 tanks placed in the suburban home community at Coral Gables, Fla., during the present year.

Fewer and larger concerns, for the greater part those prepared to specialize in this particular line, are gradually taking over the burial vault business. Nineteen twenty-five volume did not appreciably exceed that of 1924. There have been few manufacturing developments during the year, but the quality of the output has improved steadily. This should lead to increased demand.

Ornamental garden ware of the better kind is being used more extensively than ever before. During 1924 and 1925 department stores in practically every large city in the country added concrete ornamental pieces to their stock. While the best of it comes largely from Eastern and Midwestern studios where hand finishing methods are employed, several hundred producers are turning out high-grade ware made in individual plaster molds. There has also been a steady demand for the plainer ware, produced in multiple in cast iron molds.

Cement Products on the Railroads

American railroads continue each year to make more extensive use of precast cement products. During the past year they have been the largest users of concrete piles and concrete posts. Their use of cement culvert pipe has exceeded previous records. Concrete bridge slabs, used by the Western railroads, are the largest precast cement units ever made, weighing from 30 to 65 tons each. Concrete battery jars are now standard equipment and practically all interlocking equipment is now placed on concrete supports. Experiments with concrete ties continue, several types already having given satisfactory service over a term of years. The increasing cost of wooden ties give assurance that the day of the concrete tie is not far distant.

Precast concrete crossing slabs have been tried out with varying degrees of success during the past few years. Specifications for their manufacture finally have been perfected to a point where slabs can be made and laid in a manner which overcomes previous difficulties. Several railroads have instituted programs of gradual crossing slab installations eventually to reach every grade crossing on each line.

Field Gives Promise

No attempt has been made in the foregoing to do more than sketch present tendencies in a number of the more important cement products markets. The entire field of factory-made cement units embraces more than 360 important products, many of which have never been reached by any commercial survey or census. During the coming months the Bureau of the Census proposes to make as complete an analysis of the field as possible and every manufacturer should feel it his duty to co-operate wholeheartedly. Certainly, everyone interested in the numerous fields of cement products will find much of interest and probably profit, in the report of such a survey.

World's Largest Cement Products Plant to Be Built in Florida

THE Diamond Concrete Co. of Miami, a $1,000,000 corporation with offices in the Exchange building, has been incorporated for the purpose of manufacturing concrete blocks in Miami, according to an announcement by Maj. Frank Whipperman of Omaha, who owns and operates one of the most up-to-date and efficient cement products plants in the country at Omaha.

Major Whipperman said that the Diamond Concrete Co. has purchased 100 acres of rock land on the Tamiami Trail and Tamiami Canal for a plant site and quarry, and that the company will erect on this site the largest concrete block, brick, and building tile plant in the world. The plant will be equipped for a daily production of 42,000 concrete blocks, 42,000 building tile, and 250,000 standard brick. The plant will also produce 20,000 waterproof concrete face brick of many different colors and textures, having purchased the exclusive rights to manufacture under the C. S. Wert patents, according to Major Whipperman.

Rock used in the manufacture of its product will be quarried with dredges and delivered to crushing plants where it will be washed, crushed, and graded to a size suitable for the best cement products. Cement will be brought in by shipload and will be barged up the canal where mechanical conveyors will unload it into storage warehouses large enough to take care of a full cargo. It is the company's intention to always carry in stock 500,000 concrete blocks, 1,000,000 concrete building tile, and 5,000,000 standard brick, Major Whipperman said, and the plant when finished will employ over 100 men, many of them skilled mechanics.

The plant will be built under the direct supervision of Major Whipperman, who was invited by several large contractors of Miami to come here to investigate the possibilities of establishing a large plant, and who, for the past several weeks has been making a close study of the building material situation here, especially with regard to cement products.—*Miami (Fla.) Herald.*

Ohio Concrete Products Association to Meet at Toledo

THE annual state convention of the Ohio Concrete Products Association will be held at the Waldorf hotel, Toledo, Ohio, on January 12, 13 and 14.

The program has not yet been fully completed but it is planned to have many talks on the various manufacturing and selling problems of the industry. All concrete products manufacturers of Ohio are invited to attend. Reservations for hotel room may be made with G. M. Friel, 503 Dublin avenue, Columbus, Ohio, who is secretary of the association.

Cement Products Men of the Northwest Organize

REPRESENTATIVES of the manufacturers of cement products from Washington, Idaho, and Oregon held a meeting in the Multnomah Hotel, Portland, Ore., recently.

A committee composed of C. H. Bullen, president, Concrete Pipe Co., Portland; D. E. White, manager, Concrete Pipe Co., Seattle; W. F. Paddock, secretary, Peerless Concrete Products Co., Seattle; W. H. Sharp, manager, Longview Concrete Pipe Co., and Earl V. Bull, Concrete Pipe Co. of Ontario, Ore., was appointed several months ago with instructions to prepare and submit a constitution and by-laws for a cement products association. The meeting was held in response to the call of this committee.

About thirty manufacturers were present from the three states, and a permanent organization to be known as the Northwest Concrete Products Association was perfected.

W. F. Paddock, Seattle, was elected president; Roy Ward, Portland, Ore., first vice-president; W. P. Hews, Yakima, Wash., second vice-president; Earl V. Bull, Ontario, Ore., third vice-president, and W. H. Sharp, Longview, Wash., secretary-treasurer.

The following committee chairmen were appointed by the newly elected president:

Membership: D. E. White, Concrete Pipe Co., Seattle, Wash.; Legislative: E. B. Ballinger, Concrete Pipe Co., Seattle, Wash.; Standards: C. H. Bullen, Concrete Pipe Co., Portland, Ore.; Traffic: Dave Williams, Pioneer Sand and Gravel Co., Seattle, Wash.; Advertising and Publicity: Earl Bracken, Grays Harbor Cement Products Co., Aberdeen, Wash.

The invitation of W. H. Sharp was accepted and the first annual meeting will be held at Longview, Wash., January 29 and 30, 1926.

Traffic and Transportation

By EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning December 23:

Southern Freight Association Docket

24277. Clay. It is proposed to establish the following proportional rates on clay, carloads, minimum weight 50,000 lb., except as shown in Note 14 of Agent Glenn's Clay Tariff 23 from Margerum and Riverton, Ala., to Cincinnati, Ohio, when for beyond, $2.93 per net ton and to Cincinnati, $3.13 per net ton to be used in making rates to points of destination shown on pages 42 and 55 inclusive of Agent Glenn's Clay Tariff 23, I. C. C. A-510.

24299. Slag and stone. It is proposed to establish to Stantonsburg and Evansdale, N. C., a commodity rate of $2 per net ton on slag, carloads, from Eagle Mountain, Longdale and Reussens, Va., and on crushed stone, carloads, from Eagle Mountain, Indian Rock and Ricky Point, Va., this rate being the same as in effect today to Bryan, Grimsel and Simpson, N. C., and other points in the same vicinity. Lowest combination now applies.

24304. Sand and gravel, in straight or mixed carloads, mininum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Chattanooga, Tenn., and group to Canton, Ga. Present rate, $3.20 per net ton; proposed, $1.63 per net ton based on L. & N. R. R. scale, plus the proposed Georgia scale less 10% differential for joint line over single line haul. The publishing agent has been instructed to publish rate of $2.07 to apply as a temporary arrangement.

24320. Granite or stone, rough quarried or sawed, packed or not packed, hammered or chiseled; also sand rubbed (or slushed), etc. L.C.L. from points in South Carolina to points in Florida, south of Jacksonville, Fla. It is proposed to cancel present published commodity rates, applicable less than carload, permitting least combination to apply, this being the usual basis for rates to interior Florida points.

24352. Slag, granulated or not granulated. Carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Cumberland Furnace, Tenn., to Stanton, Tenn. Present rate, $9.50 per net ton. (Class "A.") Proposed, $1.47 per net ton, made in line with rates to other points on the L. & N. R. R. in the vicinity of Stanton.

24376. Sandstone and clay mixture, ground or pulverized in bags. Carloads, minimum weight 60,000 lb., from Apison, Tenn., to eastern points. Combination now applies. Proposed (in cents per net ton):

To	A. R.	R. & W.
Albany N. Y.	762	.....
Baltimore, Md.	492	492
Boston, Mass.	792	739
Bethlehem, Penn.	742	.....
Providence, R. I.	792	739
Waterbury, Conn.	792	739
Camden, N. J.	542	.....
Harrisburg, Penn.	542	.....
High Bridge, N. J.	602	.....
Jersey City, N. J.	602	558
Newark, N. J.	602	.....
New York, N. Y.	702	658
Philadelphia, Penn.	542	542
Rochester, N. Y.	762	.....
Schenectady, N. Y.	762	.....
Scranton, Penn.	742	.....
Syracuse, N. Y.	762	.....
Trenton, N. J.	602	.....
Washington, D. C.	352	.....
Alexandria, Va.	352	.....
York, Penn.	582	.....

(For Md. & Penn. delivery.)

Proposed rates are based by use of proportion of $3.52 per net ton to Potomac Yard, plus the clay proportions of the lines beyond, except to Camden and High Bridge, N. J., the proposed rates are the same as proposed to Philadelphia, Penn., and Jersey City, N. J., respectively.

24381. Limestone or marble, ground or pulverized. Carloads, minimum weight 30 net tons, from Mascot, Tenn., to Pensacola, Fla. Present rate, $3.94 per ton; proposed, $2.88 per ton, same as present rate from Sparta, Tenn., to Pensacola, Fla.

24408. Clay, ground or pulverized. Carloads, minimum weight, capacity of car, from Poorco, Tenn., to Nashville, Tenn., and Birmingham, Ala. moulding, or silica. Rush Run, Ohio, to Glass-Class "N" rates now apply. Proposed: To Nashville, $1.30; Birmingham, $2.15 per net ton made with relation to present rate from Poorco, Tenn., to Montgomery, Ala.

24410. Marble, rough, viz.: Rough quarried blocks, rough sawed, sand rubbed or slushed blocks, slabs or columns, floor tiling; building marble such as used for exterior of buildings, including blocks, slabs, columns and other pieces of marble used in the exterior of buildings. Less than carload, from Jasper, Tate, Nelson, Ball Ground and Canton, Ga., to Norton, Va., for beyond. Present rate, 79c per 100 lb. (5th class); proposed, 47½c per 100 lb., same as applicable to Roanoke, Va.

24428. Stone, crushed. Carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weights will govern, from N. & W. Ry. stations, Halsey to Vinton, Va., inclusive, to Carolina points shown in Agent Cottrell's I. C. C. No. 570. At the present time the arbitrary over Roanoke and Lynchburg as shown on page 34 of Agent Cottrell's I. C. C. No. 570 is 2½c per 100 lb. It is proposed to reduce the arbitrary over Roanoke and Lynchburg to be 2c per 100 lb.

24430. Stone, crushed. Carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from N. & M. Ry. stations, Halsey to Vinton, inclusive, to A. C. L. R. R. stations, Legare, S. C., to Puck, S. C., also all stations on the S. A. L. Ry., A. & W. R. R., A. & Y. R. R., A. & R. R. R., C. L. & C. R. R, C. & L. R. R., Cliffside R. R., D. & S. Ry., Kinston Carolina Ry., L. & S. R. R., L. A. & S. R. R., P. & N. Ry., R. & C. R. R., Moore Central Ry., Townsville R. R., B. U. C. P. R., V. & C. S. R. R., Warrenton R. R. and W. & V. R. R. It is proposed to revise the rates on stone from N. & W. Ry. stations between Roanoke and Lynchburg to hold the Roanoke rate as the maximum on traffic moving via Durham and Petersburg, and the Lynchburg rate as the maximum on traffic moving via Winston-Salem and Walnut Grove.

24448. Sandstone and clay mixture, ground or pulverized. Carloads, minimum weight 60,000 lb., from Apison, Tenn., to points in C. F. A. I. F. A. and Buffalo-Pittsburgh territories. Combination rates now apply, and it is proposed to establish rates based on Cincinnati, Ohio, combination, using to Cincinnati a proportion of $3.22 per net ton, which is the same as the rate now applicable from Black Fox, Tenn. (converted to a per net ton basis) plus the clay proportions north. To Ashland, Ky., Paducah, Ky., Belleville, Ill., Covington, Ky., and E. St. Louis, Ill., Evansville, Ind., Newport, Ky., and St. Louis, Mo., it is proposed to establish rates same as in effect on silica from Black Fox, Tenn., i. e., converted to the per net ton unit. Statement of proposed rates will be furnished upon request.

24449. Lime. It is proposed to establish rate of $4.10 per net ton on lime. Carloads, minimum weight 30,000 lb., from Kilns in Virginia on the C. & O. Ry., N. & W. Ry., So. Ry., and Virginia Ry. to Jacksonville, Fla., for beyond, based 40c per ton less than the rate proposed in Submittal No. 11180 from Virginia kilns to Jacksonville, Fla., proper.

24473. Phosphatic fluxing rock. Carloads, minimum weight capacity of car from Siglo, Tenn., to Rockdale, Tenn. Present rate, 50c per net ton (Intrastate); proposed intrastate rate, 45c per net ton, made in line, distance considered, with rates from other shipping points, to Rockdale, Tenn.

24475. Lime, (calcium) phosphate of. Carloads, minimum weight 40,00 lb., from Nashville, Tenn., to Toronto, Ont., Canada. Present rate, 66c per 100 lb. (combination); proposed, 61c per 100 lb., which will equalize the rate available on Louisville, Ky., combination. The proposed rate to apply via Cairo or Metropolis gateways.

Central Freight Association Docket

12084. Crushed stone. Osgood, Ind., to Columbia (Hamilton Co.), Ohio. Cincinnati, Ohio, and New Albany, Ind. Present rate, 95c to Columbia and Cincinnati, Ohio, and $1.15 per net ton to New Albany, Ind. Proposed, 70c to Columbia (Hamilton Co.), Ohio; 80c to Cincinnati, Ohio, and $1.00 per net ton to New Albany, Ind.

12093. Lime. Marble Cliff, Ohio, to Kane, Johnsonburg and Ridgeway, Penn. Present, 22c; proposed, 17½c.

12117. Crushed stone. St. Paul, Ind., to Blocher, Ind. Present rate, 13½c; proposed, 95c per ton.

12124. Sand, blast, engine, foundry, glass, per 100 lb., minimum weight 40,000 lb., on lime, mere, Creighton and Brackenridge, Penn. Present rate, $1.76 per net ton; proposed, $1.23 per ton of 2,000 lb.

Southwestern Freight Bureau Docket

6708. Lime. From interstate points to points in Oklahoma. To establish a minimum weight of 30,000 lb. on lime carloads, from St. Louis, Mo., Memphis, Tenn., Peoria, Chicago, Ill., Minneapolis and St. Paul, Minn., to points in Oklahoma. The minimum weight on lime carloads, in St. L.-S. F. Ry. Tariff 69K, is 30,000 lb., to Oklahoma. The classification minimum weight is 30,000 lb. and it is contended there is no reason why the minimum weight from all origin points to Oklahoma should not be 30,000 lb.

6742. Limestone. From points in Missouri to points in Missouri. To establish specific rates on limestone, crushed or ground, having value for soil fertilization purpose only, carloads, minimum weight 90% of the marked capacity of car, from Phenix and Osceola, Mo., to stations in St. L.-S. F. Ry. Tariff No. 4101A within a radius of 250 miles, based upon mileage prescribed by the Missouri Public Service Commission in Case No. 3421. The above change is necessary in order to permit shippers at Phenix and Osceola, Mo., to compete with other shippers now having these rates.

6747. Limestone. From Carthage, Mo., to points in Oklahoma. To establish the following distance rates in cents per 100 lb. on limestone, agricultural, carloads, (to apply only on crushed agricultural limestone, which has passed or will pass through a screen with round holes ⅛-in. or less in diameter) minimum weight 90% of marked capacity of car, except that when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car the actual weight will apply. In no case shall the minimum weight be less than 40,000 lb., from Carthage, Mo., to points in Oklahoma on the Mo. Pac. R. R.

Distance in miles—	Rates
50 miles and under	60
60 miles and over 50	65
70 miles and over 60	70
80 miles and over 70	75
90 miles and over 80	85
100 miles and over 90	90
110 miles and over 100	95
120 miles and over 110	100
140 miles and over 120	110
150 miles and over 140	115
170 miles and over 150	120
180 miles and over 170	125
190 miles and over 180	130
200 miles and over 190	135
220 miles and over 200	140
240 miles and over 220	150
260 miles and over 240	155

This stone is to be used as a fertilizer and in order to enable farmers to use it, a lower basis of rates, it is contended, must be provided.

6751. Crushed stone from Krause, Ill., to points in Missouri. To establish the following rates in cents per 100 lb. on crushed stone (broken stone ranging in size up to 200 lb. in weight) including ground limestone but not including gypsum rock, carloads, minimum weight 90% of marked capacity of car except when cars are loaded to full visible capacity actual weight will govern, from Krause, Ill., to points in Missouri shown below:

Station	Rate
South Webster, Mo., to Minoke, Mo.	80
Crescent, Mo., to Robertsville, Mo.	100
Laret, Mo., to Stanton, Mo.	110
Acid, Mo., to Leasburg, Mo.	130
Hofflins, Mo., to Franks, Mo.	140
Wye, Mo., to Swedeborg, Mo.	160
E. Richland, Mo., to Lebanon, Mo.	170
Brush Creek, Mo., to Sampson, Mo.	170
Little Rock, Mo., to McBride, Mo.	130
Nianqua, Mo., to Strafford, Mo.	170
Boyd, Mo., to Salem, Mo.	140
Griffith Spur, Mo., to Cherry Valley, Mo.	140
Faulkner, Mo., to Sligo, Mo.	140
Pisgah, Mo., to Decamp, Mo.	140
Mutual, Mo., to Henke, Mo.	80
Oak Ridge Farm, Mo., to Selma, Mo.	100
Rush Tower, Mo., to White Sand, Mo.	110
Killian, Mo., to Bainbridge, Mo.	140

There is nearing completion a spur track of the Mo. Pac. R. R. into the stone quarry at Krause, Ill., and it is desired that through rates be established.

6761. Lime. From points in Arkansas to points in Colorado. To establish a rate of 36c per 100 lb. Minimum weight 30,000 lb. and a rate of 30c

common, hydrated, quick or slacked, carloads, from Limedale Spur and Ruddells, Ark., to Colorado common points. Shippers have requested that rates be established from Limedale Spur and Ruddells, Ark., on basis of 1.5c per 100 lb. higher than currently applicable from Johnson's, Ark., and Springfield, Mo.

6769. Ground rock, from Harrys and Eagle Ford, Texas, to points in Oklahoma. To establish mileage scale of rates via two, three, four or more lines the same as at present published in Item 4109 of S. W. L. Tariff No. 26X on southbound traffic on ground rock, carloads, minimum weight, marked capacity of car except when cars are loaded to actual visible loading capacity actual weight shall govern, but not less than 50,000 lb., from Harrys and Eagle Ford, Texas, to Oklahoma points. Shippers call attention to rates from Oklahoma to Texas points and request they have the same measure of rates from Texas to Oklahoma points.

Trunk Line Association Docket

12899. (a) Building lime. Carloads, minimum weight 30,000 lb. (b) Agricultural, chemical, gas, glass or land lime, carloads, minimum weight 30,000 lbs., or ground limestone, carloads, minimum weight 50,000 lb., from Bellefonte and Pleasant Gap, Pa., to Egg Harbor, N. J. (a) 17½c and (b) 16c per 100 lm. Also to take care of intermediate territory, Bellefonte and Pleasant Gap, Pa., to Hammonton, N. J.

Reason for this proposal—Only rates available are 6th class rates and proposed rates are favorable with others for like distances.

12092. Lime. Carloads, minimum weight as per O. C., from Kenova, W. Va., to Two Mile, Dundon, West Sutton, Gilmer and various other West Virginia points, rates ranging from 12½ to 18½ per 100 lb.

Reason for this proposal—The proposed rates are fairly adjusted with relation to rates in the same territory for one line haul.

Western Trunk Line Docket

1062-G. Sand and Gravel. Carloads, from Eddyville, Ia., to points shown below:

To	Rates in cents per 100 lb. Present	Proposed
Mercer, Mo.	8	150
Alvord, Mo.	9	150
Princeton, Mo.	9	150
Mill Grove, Mo.	10	150
Spikards, Mo.	11	150
Tindall, Mo.	11½	150
Trenton, Mo.	12	150

Minimum weight 90% of marked capacity of car, but not less than 40,000 lb.

Sup. 1 to 4701. Gypsum. Carloads, from Centerville, Ia., to C. M. & St. P. stations, Hudson to Mitchell, S. D., inclusive. Present, 19c per 100 lb., minimum weight 40,000 lb. Proposed, 17c per 100 lb., minimum weight 60,000 lb. (in addition to present rate as shown above).

5017. Stone, crushed, broken (ranging in size up to 200 lb. in weight) including ground limestone, but not including gypsum rock. Carloads. From Krause, Ill., to various points in Missouri. Present—combination rates. Proposed—establish the Single Line Mileage Scale prescribed in I. C. C. Docket 9702 to points on the Mo. Pac. R. R. and the Joint Line 9702 Scale to points on other lines. Minimum weight 90% of marked capacity of car, except that when actual weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will be the minimum weight, but in no case shall the minimum weight be less than 40,000 lb.

5018. Gravel, novaculite or ganister. Carloads, from Elco and Gravel Pit, Ill., to Mexico, Mo. Present, $2.48 per net ton (St. Louis, Mo., combination made to St. Louis, Mo., $1.28 beyond $1.22). Proposed, $1.76 per net ton to apply via M. & O. R. R., E. St. Louis, Ill., and Wabash Ry. Minimum weight 60,000 lb.

New England Freight Association Docket

9341. Granite, rough quarried. Minimum weight 60,000 lb., from Bradford, R. I., to Barre, Vt., 20, to Concord and Milford, N. H., 17. Reason: To permit of movement for dressing and reshipping.

9382. Lime. From Cheshire, Farnams, North Adams, Renfrew, Richmond and Zylonite, Mass., to stations taking Boston Rate Basis on the B. & M. R. R. and N. Y. N. H. & H. R. R. under Note 77 of F Van Ummersen's I. C. C. 50. Reason—to place the B. & A. R. R. on an equal basis with competing carriers.

9390. To add Maine Central R. R. in list of origin stations in Item 2465 F. Van Ummersen's I. C. C. 50 applying on stone and granite, classified sixth class, etc., to destination stations in Canada, taking Rate Group numbers 76C and 76D as shown in Note 132. Reason—To establish from Me. C. R. R. points same rates Canadian Pacific Ry territory in Canada as currently effective to the same territory for Canadian National Rys. delivery.

Missouri Cement Rates

A FINDING of unreasonableness and an award of reparation have been recommended by Examiner Thomas E. Pyne, in No. 12950, Atlas Portland Cement Co. vs. Director-General, as agent, as to rates and charges on cement, from Ilasco, Mo., to destinations in Illinois, Wisconsin, Michigan, Minnesota, Iowa, South Dakota, Nebraska and Kansas, and over interstate routes, to destinations in Missouri.

Pyne said the rates on cement moving from Ilasco, near Hannibal, Mo., from August 8, 1918, following the original report in Western Cement Rates, 48 I. C. C. 210, were unreasonable to the extent they exceeded those established February 29, 1920, following the Commission's second report in that case. That finding is confined to interstate rates.

The complaint covered both state and interstate rates. Pyne said the Commission should find, as to Missouri state rates, that they had not been shown to have been unreasonable. He pointed out that the Commission, in the original report, refused to deal with Missouri state rates because of the insufficiency of the record. He said the present record afforded no basis for a finding of unreasonableness or undue prejudice as to such rates.

The examiner treated the complaint as one demanding reparation on shipments of cement that moved under the rates established by the railroads in compliance with the first report and order in Western Cement Rates to the basis of the "short-line workable route" regardless of the number of lines that might have to be included in such routes and to the basis of the lowest rate that could be figured, by using, where necessary, longer routes through lower rated territory, rather than the rates resulting from the use of shorter routes through higher rated territory.

Pyne said the trouble arose, apparently, from the use of the words "short-line workable route" without limitation in connection with that part of the order. The carriers, he said, construed that language to mean the short-line distances over existing routes ordinarily used and in connection with which a basis for divisions had been established. The complainant, Pyne said, took the position that in the period between the two decisions in that case the rates charged it were in violation of an outstanding order of the Commission, for one or more of six reasons set up by the complainant as being guides established by the original decision.

"In short," said Pyne, "complainant flatly contends that under the decision of the Commission it was entitled to the lowest possible rates that could be figured by the use of the bases prescribed, and that the rates published were unreasonable and unduly prejudicial because of the failure of the defendants to use the routes and scales which would produce the lowest rates."

In behalf of the Director-General three objections were made. The examiner referred to them as technical. The first was to the reception of testimony as to shipments from Ilasco on the ground that the complaint was confined to shipments from Hannibal, three miles away. Pyne said that that was without merit because the Commission itself referred to the plant at Ilasco, three miles from Hannibal, as being at Hannibal. The second was to the reception of testimony as to shipments to points other than shown in the exhibits. Pyne overruled that because there was a general averment covering destinations in the various states specified. The third was as to the jurisdiction of the Commission to award reparation on intrastate traffic. He said that apparently that was abandoned on brief, but he pointed out that that question was well settled in favor of jurisdiction on the part of the Commission. —*Traffic World.*

Order Crushed Stone Refund

REPARATION amounting to 2 cents per 100 lb. on six carloads of crushed stone shipped from Louisville to Omaha in August, 1923, is awarded by the Kansas railway commission to Sunderland Bros. of Louisville, Ky., as against the Northwestern railroad, in an order issued recently.

The commission denies reparation asked for against the Burlington on its part of the joint haul of these cargoes, holding that its charges were not unreasonable. It overrules the Burlington contention that the commission had no jurisdiction to allow reparation.

The Burlington charged 3 cents per 100 lb. for a haul of 27.9 miles. Louisville to South Omaha, and the Northwestern collected 3½ cents to transport it from South Omaha to team tracks in Omaha, a distance of 5.1 miles.

A year ago, the commission found that 4½ cents was a proper joint rate on crushed stone shipments from Louisville to Fremont via Omaha, 68 miles, and for intermediate distances. That is the rate which has been collected since then.

Now the commission says that the Northwestern should have charged Sunderland Bros. not more than 1½ cents per 100 lb. in 1923, and directs a refund to that firm covering the excess.—*Lincoln (Neb.) Star.*

Southern Producers Fight Freight Increases

THE freight rate situation in Southern territory on sand, gravel and crushed stone, which has been threatening for some time, is now squarely before shippers, on account of pending proceedings before the Interstate Commerce Commission.

The carriers are attacking the new Georgia mileage scales on the ground of discrimination against interstate traffic and are seeking higher state rates.

The Montgomery, Ala., and Chattanooga shippers have also filed complaints with the Interstate Commerce Commission attacking various rate situations in the South.

These proceedings will probably be combined for joint hearing and the probabilities are that any basis fixed by the Interstate Commerce Commission will be adopted in the future as the standard for rates in Southern territory on sand, gravel, slag, and crushed stone.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)**	Dec. 21	100	109	109	1¾% quar. 25% ex. Dec. 1
Alpha Portland Cement Co. (preferred)**	Dec. 18	100	109	.....	1½% quar. Sept. 1
Arundel Corporation (sand and gravel—new stock)	Dec. 24	No par	34¾	35⅛	30c quar., 60c ex, Jan. 2
Atlas Portland Cement Co. (common)	Dec. 21	No par	52½	56¾	50c quar.
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)**	Dec. 18	33⅓	45	.....	2% quar. Oct. 1
Bessemer Limestone and Cement Co. (common)‡	Dec. 17	100	140	145¾	1½% quar. Jan. 1, 4% ex. Jan. 1
Bessemer Limestone and Cement Co. (preferred)‡	Dec. 17	100	106½	110	1¾% quar. Jan. 1
Bessemer Limestone and Cement Co. (convertible 8% notes)‡	Dec. 17	.....	120	130	8% annual
Boston Sand and Gravel Co. (common) (r)	Dec. 16	100	60	.....	2% quar. July 1
Boston Sand and Gravel Co. (preferred) (d)	Dec. 16	.....	.....	80	1¾% quar. Oct. 1
Boston Sand and Gravel Co. (1st preferred) (d)	Dec. 16	.....	.....	90	2% quar. Oct. 1
Canada Cement Co., Ltd. (common)	Dec. 24	100	103⅝	104	1½% quar. Jan. 16
Canada Cement Co., Ltd. (preferred) (f)	Dec. 16	100	115½	116½	1¾% quar. Nov. 16
Canada Cement Co., Ltd. (1st 6's, 1929) (f)	Dec. 16	.....	102¾	103½	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944) (f)	Dec. 16	100	92½	96½	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Dec. 21	No par	23	26	50c quar. Oct. 10
Charles Warner Co. (preferred)	Dec. 21	100	98	102	1¾% quar. Oct. 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929 (r)	Dec. 16	100	108	112	
Cleveland Stone Co.	Dec. 22	.....	140	150	1½% quar., 1% ex. Dec. 1
Connecticut Quarries Co. (1st Mortgage 7% bonds) (s)	Dec. 16	100	103	.....	
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (4)	Dec. 16	.....	72	.....	
Dolese and Shepard Co. (crushed stone) (a)	Dec. 24	50	73	75	$1.50 quar. Jan. 1
Eastern Brick Corp. (7% cum. pfd.) (1)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common)	Nov. 3	50	7½c(x)	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
Giant Portland Cement Co. (common)**	Dec. 18	50	37	40	
Giant Portland Cement Co. (preferred)**	Dec. 18	50	47	50	3½% s.-a. Dec. 15, plus 10% arrears
Ideal Cement Co. (common)‖	Dec. 24	No par	78	80	$1 quar. Jan. 2. 50c ex. Dec. 27
Ideal Cement Co. (preferred)‖	Dec. 18	100	105	107	1¾% quar. Jan. 2
International Cement Corporation (common)	Dec. 23	No par	65⅛	67⅞	$1 quar. Dec. 31
International Cement Corporation (preferred)**	Dec. 21	100	103½	104	1¾% quar. Dec. 31
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Kelley Island Lime and Transport Co.	Dec. 22	100	120⅛	125¾	$2 quar. $2 ex. Jan. 2
Lawrence Portland Cement Co.**	Dec. 18	100	110	.....	2% quar.
Lehigh Portland Cement Co.‖	Dec. 18	50	90	93	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially up to 1930) (k)	Dec. 18	100	99½	100½	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially from 1930 to 1935) (k)	Dec. 18	100	97	98½	
Michigan Limestone and Chemical Co. (common)‖	Dec. 18	.....	23½	.....	
Michigan Limestone and Chemical Co. (preferred)‖	Dec. 18	.....	23½	.....	1¾% quar. July 15
Missouri Portland Cement Co.	Dec. 24	25	62	62	50c quar.; 25c ex. Dec. 18
Missouri Portland Cement Co. (serial bonds)	May 29	.....	104½	104½	3¼% semi-annual
Monolith Portland Cement Co. (common) (c)	Dec. 17	.....	8	8¼	
Monolith Portland Cement Co. (units) (c)	Dec. 17	.....	23¼	24½	
Monolith Portland Cement Co. (preferred) (c)	Dec. 17	.....	7¼	7¾	
Newaygo Portland Cement Co.*	Dec. 17	.....	120	130	
New England Lime Co. (Series A, preferred) (i)	Dec. 16	100	96½	99	
New England Lime Co. (Series B, preferred) (i)	Dec. 16	100	96½	99	
New England Lime Co. (V.T.C.) (i)	Dec. 16	.....	23	25	
New England Lime Co. (6s, 1935) (m)	Dec. 17	100	98	100	
North American Cement Corp. 6½s 1940 (with warrants)	Dec. 23	.....	99⅜	99⅜	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common) (z)	Nov. 13	.....	94	99	2 mo. period at rate of 7%
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1 5⅝	
Pacific Portland Cement Co., Consolidated (§)	Dec. 18	100	87	87½	
Pacific Portland Cement Co., Consolidated (secured serial gold notes)§	Dec. 17	.....	99½	100¼	3% semi-annual Oct. 15
Peerless Portland Cement Co.*	Dec. 17	10	5½	6½	
Petoskey Portland Cement Co.*	Dec. 17	10	9	10	1½% quar.
Phosphate Mining Co. (1)	Nov. 25	.....	1@5	.....	
Pittsfield Lime and Stone Co. (preferred)	.....	100	.....	.....	2% quar. Apr. 1
Rockland and Rockport Lime Corp. (1st preferred) (d)	Dec. 16	100	.....	98	3½% semi-annual Aug. 1
Rockland and Rockport Lime Corp. (2nd preferred) (d)	Dec. 16	100	.....	70	3% semi-annual Aug. 1
Rockland and Rockport Lime Corp. (common) (d)	Dec. 16	No par	.....	70	1½% quar. Nov. 2
Sandusky Cement Co. (common)*	Dec. 22	100	107	112	$2 quar. $3 ex. Dec. 31
Santa Cruz Portland Cement Co. (bonds) (§)	Dec. 18	.....	104	106	6% annual
Santa Cruz Portland Cement Co. (common) (§)	Dec. 17	50	87½	100	$1 quar. $1 ex. Dec. 24
Simbroco Stone Co. (pfd.)	Dec. 12	.....	.....	.....	$2 Jan. 1
Superior Portland Cement Co.	Mar. 1	100	.....	120	
Tidewater Portland Cement Co. (common) (3)	Nov. 25	.....	8½	.....	
United States Gypsum Co. (common)	Dec. 24	20	156	157	2% quar. Dec. 31, $2 plus 15% stock ex. Dec. 31
United States Gypsum Co. (preferred)	Dec. 24	100	117	118	1¾% quar. Dec. 31
Universal Gypsum Co. (common)†	Dec. 24	No par	20½	22	
Universal Gypsum V. T. C.†	Dec. 24	No par	19½	21	
Universal Gypsum Co. (preferred)†	Aug. 5	.....	76	.....	1¾% quar. Sept. 15
Universal Gypsum Co. (1st mortgage 7% bonds)†	Dec. 24	.....	99	(at 6½%)	
Union Rock Co. (7% serial gold bonds) (y)	Dec. 18	100	100½	102	
Vermont Milling Products Co. (slate granules) 50 sh. common and 100 sh. pfd. (2)	Nov. 3	.....	$1 for the lot	.....	
Wabash Portland Cement Co.*	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940) (o)	Dec. 21	100	98½	.....	
Wolverine Portland Cement Co.	Dec. 21	10	6⅝	6⅝	2% quar. Aug. 15

*Quotations by Watling, Lerchen & Co., Detroit, Mich. **Quotations by Bristol & Bauer, New York. †Quotations by True, Webber & Co., Chicago. ‡Quotations by Butler, Beadling & Co., Youngstown, Ohio. §Quotation by Freeman. Smith & Camp Co., San Francisco, Calif. ‖Quotations by Frederic H. Hatch & Co., New York. (a) Quotations by F. M. Zeiler & Co., Chicago, Ill. (b) Quotations by De Fremery & Co., San Francisco, Calif. (c) Quotations by A. E. White Co., San Francisco, Calif. (d) Quotations by Lee, Higginson & Co., Boston, Mass. (f) Nesbitt, Thomson & Co., Montreal, Canada. (g) Neidecker and Co., Ltd., London, England. (i) E. B. Merritt & Co., Inc., Bridgeport, Conn. (k) Peters Trust Co., Omaha, Neb. (m) Second Ward Securities Co., Milwaukee, Wis. (o) Central Trust Co. of Illinois, Chicago, Ill. (r) J. S. Wilson Jr. Co., Baltimore, Md. (s) Chas. W. Scranton & Co., New Haven, Conn. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on Nov. 3, 1925. (y) Dean, Witter & Co., Los Angeles, Calif. (z) Hemphill, Noyes & Co., New York. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass. (3) Price obtained at auction by Weilepp-Bruton & Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day & Co., Boston, Mass.

Wisconsin Producers Look for Better Year in 1926

THE Wisconsin Mineral Aggregate Association held its seventh regular annual meeting in Milwaukee on December 17. The annual banquet was held in the evening.

This association, owing to its custom of holding regular monthly meetings, lays less stress on the annual meeting than some others and the principal business transacted is the election of officers and the reading of the executive secretary's report which summarizes the work of the year and gives something of the prospects for the year to come.

The officers and executive board members elected were: George C. Brew, president; M. W. Deutsche, vice-president; E. E. Gillen, secretary-treasurer, and (for the board) R. C. Brown, Sr., C. R. Nutt, L. L. Laun and G. D. Francey.

The report was read by Norman Wilson, executive secretary and was, in part, as follows:

At the start of the year 1925, the highway program of Wisconsin was somewhat indefinite. The general talk during the session of the legislature was that the highway program would be seriously curtailed; and this was evident during the year. However, the aftermath of the legislative session was that we now have in Wisconsin an up-to-date, progressive, highway construction program, which will bear fruit in the year 1926.

The only highway work that was done during 1925 was federal aid and a few isolated portions of state and county aid, making a total of about 125 miles, 150 miles less than that of the previous year. Nineteen twenty-five was about the poorest highway construction year that we have witnessed in Wisconsin since the state trunk system was started.

The city concrete street construction showed a small increase over that of 1924. This total of about 1,575,000 square yards should be exceeded in 1926.

The lack of highway work in Wisconsin, coupled with the small amount of work done in Illinois during the past year brought about a huge over-production in the sand, gravel and crushed stone industry and we found that many companies were seeking new markets, and extending their radius of shipment.

During the year we have continued our campaign for the use of better materials, not only by descriptive literature, but by personal letters to all architects, engineers, contractors and concrete products manufacturers. We know that this campaign is bearing fruit, because on numerous occasions this office has been called by many of the leading architects, to give them further information. This is a campaign that should be carried on even more intensively than in the past, but, in order to do so, it will be necessary to spend more money than we have been doing. With a possible shortage of tonnage during the year, we have been reluctant to increase any of our expenditures, but it would be good policy to extend and broaden this educational work.

Our relationship with the contractors and their organizations is very friendly and I believe that a membership in our association is recognized by the trade as being worth-while.

The outlook for 1926 is extremely promising, especially now that we have a definite highway law. There will be approximately 150 miles of federal aid and state aid construction this coming year. With the additional work to be done by the various counties, this should be increased by another 100 or 150 miles, making a total of 250 to 300 miles of work, which is more than a 100% increase over 1925. The city work should show at least a 50% increase, or in round numbers, the city work should equal approximately 2,500,000 sq. yd. This increase is due to the fact that cities are now receiving an allotment on the gasoline tax, for improvement of state aid roads within their border; also, there has been a natural growth of concrete street construction. General building should show an increase for the coming year and, as better material is being demanded for this work, this market is extended for the commercial producers.

In the administration of the association, we have always tried to hold as our ideal the reason for the organization of the same and it might be sufficient to say here that we have tried to have our members play the game squarely, to do everything to better the conditions of the industry, believing that through these methods the individual companies would benefit. It is questionable whether or not the markets would have been extended as they have been, without the association. It is entirely possible that, due to lack of intimacy among the various companies, the growth would have been stifled.

We have been fortunate to have each year an executive board that, without any selfish purpose, has been willing to devote time and thought for the betterment of the industry.

Advance Program of American Road Builders' Association Convention

Tuesday, Jan. 12—Morning Session

William H. Connell Presiding

10:00 A. M.—Addresses by Hon. Len Small, governor of Illinois; Hon. W. E. Dever, mayor of Chicago; C. H. Markham, president, Illinois Central railroad and a prominent financier (name not yet announced).

Tuesday Afternoon Session

ENGINEERING PROBLEMS

Frank F. Rogers Presiding

2:00 to 5:00 P. M.—General subject—"Financing and Locating Highways."

CONSTRUCTORS' PROBLEMS

James Cameron Presiding

2:00 to 5:00 P. M.—General subject—"Making the Contracting Business Pay."

Wednesday Morning Session (General)

JOINT MEETING WITH THE NATIONAL HIGHWAY TRAFFIC ASSOCIATION

A. H. Blanchard Presiding

10:00 to 12:00 A. M.—General subject—"Traffic."

Wednesday Afternoon Session

ENGINEERING PROBLEMS

George W. Borden Presiding

General subject—"Construction."

2:00 P. M.—"Governing Factors in Selection of Durable Types of City Pavements," C. M. Pinckney, chief engineer, Borough of Manhattan, New York City.

3:00 P. M.—"Recent Developments in Concrete Paving Practice," H. E. Surman, Illinois Dept. of Public Works and Buildings.

4:00 P. M.—"Recent Developments in Bituminous Paving Practice," Harry McCahan Rex, construction engineer, North Carolina State Highway Commission.

CONSTRUCTORS' PROBLEMS

W. F. Creighton Presiding

General subject—"Practical Operating Methods."

2:00 P. M.—"Increased Costs Due to Improper Fine Grading Methods," C. J. Moritz, contractor, Effingham, Ill.

2:45 P. M.—"Relative Merits of Yard Handling of Materials with Derricks, Cranes, Conveyors, Etc.," Robert P. Petersen, Henry W. Horst Co., Rock Island, Ill.

3:30 P. M.—"Economics of Equipment Standardization," Speaker not yet selected.

4:15 P. M.—"How to Stop Cement Over-Run," Robert E. O'Connor, J. C. O'Connor and Sons, Fort Wayne, Ind.

Wednesday Afternoon at 4:30

BUSINESS MEETING

Wednesday Evening

7:30 P. M.—Annual banquet, Gold room, Congress hotel, Charles M. Schwab, principal speaker.

Thursday Morning Session

ENGINEERING PROBLEMS

Paul D. Sargent Presiding

10:00 to 12:00 A. M.—General subject—"Operation and Maintenance."

CONSTRUCTORS' PROBLEMS

Edward McCrady Presiding

General subject—"Enlarging the Contractors' Field."

10:00 A. M.—"Economic Reasons for Winter Letting of Road Work," J. H. Mullen, vice-president, Nelson, Mullen, Nelson, Inc., Minneapolis, Minn..

11:00 A. M.—"Relations Between General Contractor and Sub-Contractor" C. E. Hair, president, Belmont Trucking Co., Terre Haute, Ind.

12:00 Noon—"Resurfacing and Maintenance Work as a Future Field for the Contractor," George F. Schlesinger, director of highways and public works, Columbus, Ohio.

Thursday Afternoon Session (Final)

S. M. Williams Presiding

General subject—"The Contractor and the Engineer."

2:00 P. M.—"One-Sided Clauses in Public Works Specifications," General R. C. Marshall, jr., general manager of Associated General Contractors of America.

3:00 P. M.—"Relations Between the Contractor and the Engineer," C. M. Babcock, state commissioner of highways, St. Paul, Minn.

Missouri Valley Producers Hold Seventh Annual Meeting

THE Missouri Valley Sand and Gravel Producers Association held its seventh annual meeting at the Kansas City Athletic Club in Kansas City, Mo., Thursday, December 17. All reports agree that this was one of the most successful meetings that has been held. The attendance, as will be noted from the registration, was excellent, and the program was interesting all the way through.

In opening the meeting the president, W. E. Rogers of the Arkansas River Sand Co., said, in part:

The President's Address

Gentlemen, you are pretty well acquainted with your executive committee's endeavors during the current year; you will become more familiar as the program progresses. Will it not, therefore, suffice to say that during 1925 we had a great many troubles, the most of which never happened—thanks to our association activities. A report, with its usual complimentary remarks, is water over the dam, except as we may profit by our experience.

It is the purpose of this association to establish in each community a friendly contact, based on understanding. Such a relationship only can lead to mutual benefit. Persistent antagonism, prompted by selfish greed, though masked in a garb of diplomacy, imperils the investment of capital, jeopardizes the interest of all. Therefore, let us have peace at any price—but not sand—that must pay a fair return commensurate with the services rendered.

Can the desired result be attained by exploiting our competitor for information with which to make capital, or has our record inspired his confidence to such an extent that he feels free to discuss credits, etc.? Do we accept the information in a spirit of association cooperation or feel that through our cleverness we procured the same?

Have we darkened each others doors with social calls, or waited until there was "blood on the moon," and then have had only the unpleasant thing to say?

Most of us have given our time and money to this work, while some have only given financially. Could we make an investment pay in our individual sand business if treated in a like manner? One or two have discontinued financial support until we are 100% perfect, at which time we will have no use for their money. They reason like the farmer who said, "Old cow, you get no more chops till you give more milk."

Our interest in the welfare of this industry should prompt attendance at our meetings. If the interest is not what it should be let us hope our sense of loyalty to the officers who are trying to serve us, will command our presence. In this connection, let me add, your executive committee sincerely desires and cordially invites your counsel.

Providing there any here who are skeptical as to the merit of association work, what have you to offer in its place. Should you have something in mind let's have it, if not then help to make the most through the instrument at hand. Since talking problems over with many producers I have come to accept as a true story, where the man in the army thought every one out of step but him.

The treasurer's report showed the association to be in excellent financial condition, with income exceeding expenditures by about $200. This report was followed by the reports from the different districts which were given by the following:

Missouri River, A. E. Fisher; Upper Kaw River, Harold N. Richardson; Lower Kaw River, F. W. Peek; Arkansas River, R. H. Cubbon; Oklahoma, J. M. Chandler.

There was but one speaker, Clyde M. Reed, of Kansas City, whose subject was: "Service of the Trans-Missouri-Kansas Regional Advisory Board, American Railway Association, Car Service Division, to the Missouri Valley Association of Sand and Gravel Producers." Mr. Reed was listened to attentively and at the close of his talk the members commended the work of the board he represented and promised it their wholehearted support.

T. R. Barrows, executive secretary of the National Association, was unable to be present as had been expected. John Prince, president of the National Association, gave an outline of the work of the National Association's work in the past year and explained some of the things it was expected that the association would do in the coming year.

Business for the Year Reported About Normal

To judge from the district reports presented, producers have found business for the past year to be about normal. The report on all districts showed an increased production of about 16% but there was a slight decrease in the price received. The outlook for the coming year is expected to be good. The costs of production for the district appear to have diminished about one cent per ton.

The usual social features. the luncheon and the dinner, provided by the Kansas City producers, were as enjoyable as they always are.

The following officers were elected to serve in 1926:

President, R. J. Stewart, Pioneer Sand Co., St. Joseph, Mo.; vice-president, N. C. Dunn, Arkansas City Sand Co., Arkansas City, Kan.; treasurer, F. H. Gades, Wear Sand Co., Topeka, Kan.; secretary, W. E. Johnson, Kansas City (re-elected); executive committee, R. J. Stewart, chairman; W. C. Dunn, F. H. Gades, H. B. Thompson, A. E. Fisher, Harold N. Richardson, A. W. McQuown, L. A. Daly, Cleveland.

Registration

H. H. Allison, Manhatton Sand Co., Salina, Kansas; W. H. K. Bennett, W. H. K. Bennett Co., Chicago; John I. Corrall, American Sand Co., Kansas City; Geo. H. Cook, Stewart Sand Co., Kansas City; F. M. Colburn, Muncie Sand Co., Kansas City; J. I. Cowell, Reed & Wheelock, Clay Center, Kansas; J. M. Chandler, Price Sand Co., Tulsa, Okla.; R. H. Cubbon, Jackson-Walker Coal Mining Co., Wichita, Kansas; L. A. Daly, J. A. Daly, Osage Sand Co., Nevada, Mo.; E. C. Dresser, Dresser Sand Co., Leavenworth, Kansas; N. C. Dunn, Arkansas City Sand Co., Arkansas City, Kansas; D. D. Eshelman, Arkansas River Sand Co., Oxford, Kansas; A. E. Fisher, Glasgow Sand Co., Glasgow, Mo.; F. H. Gades, Wear Sand Co., Topeka, Kansas; L. A. Johnson, J. A. Daly-Osage Sand Co., Nevada, Mo.; W. E. Johnson, secretary Mo. Valley Association, Kansas City, Mo.; E. L. Kirkham, Stewart Sand Co., Kansas City; A. H. Koepke, Wear Sand Co., Topeka, Kansas; Otto Kuehne, Jr., Kansas Sand Co., Topeka, Kansas; L. E. Leach, Muncie Sand Co., Kansas City; A. N. McQuown, Empire Sand and Material Co., Wichita, Kansas; Harry E. Moore, Mo. River Sand and Gravel Co., Boonville, Mo.; W. A. Pirnie, F. W. Peck, Muncie Sand Co., Kansas City; John Prince, Stewart Sand Co., Kansas City; J. W. Reed, Cincinnati Rubber Mfg. Co., Chillicothe, Mo.; Harold N. Richardson, Topeka Sand Co., Topeka, Kansas; W. E. Rogers, Arkansas River Sand Co., Sand Springs, Okla.; H. E. Schellberg, Lyman-Rickey Sand and Gravel Co., Omaha, Neb.; W. E. Seright, Empire Sand and Material Co., Wichita, Kansas; R. J. Stewart, Pioneer Sand Co., St. Joseph, Mo.; W. J. Stewart, Stewart Sand Co., Kansas City; H. B. Thompson, American Sand Co., Kansas City; H. A. von Unwerth, Yahola Sand and Gravel Co., Muskogee, Okla.; A. E. Wallace, American Sand Co., Kansas City; A. Wallau, Geo. F. Wallau, Jefferson City Sand and Gravel Co., Jefferson City, Mo.; T. G. Wear, Wear Sand Co., Topeka, Kansas; H. E. West, West Sand Co., Muskogee, Okla.; G. E. Williamson, Tulsa Sand Co., Tulsa, Okla.; E. B. Winkler, Stewart Sand Co., Kansas City; and E. E. Woodson, Muncie Sand Co., Kansas City.

Stewart Sand Company Safety Council

TO further promote safety around the various plants and operations of the company, the Stewart Sand Co., Kansas City, Mo., has recently formed a full-fledged Safety Council—"with officers, committees 'n everything." The first meeting was held at the company offices on November 18; and the following officers elected: Horace Butler, chairman; C. T. Marshall, secretary.

Committees were appointed for the purpose of looking after safety appliances and the promotion of measures of safety at each plant.

Regular meetings will be held, from month to month, at which safety will be discussed and reports made.

An announcement in *Better Building*, house organ of the company, states: "While we have always tried to practice 'Safety First' everywhere in our organization—this is our first actual Safety Council; and everyone believes it will help promote this important phase of a large operating organization like ours."

Manganese Steel—A Survey of Its Use in the Rock Products Industry

Widespread Experience Proves That the Use of Manganese Steel Has Been an Important Factor in the Progress Toward Lower Costs

ROCK PRODUCTS has recently completed, with the co-operation of its readers, the most comprehensive survey of experience with manganese steel ever attempted in any large industry. A study and summarizing of results has proved most interesting and enlightening, and should prove of considerable value to all responsible for operation and production. Over 700 replies were received. Two-thirds of these were from users—the other one-third have never used manganese steel.

What Is Manganese Steel?

Cast manganese steel, according to Hall and Hanks* should have approximately the following analysis:

	Per cent
Carbon	1.00- 1.40
Silicon	0.30- 0.80
Manganese	11.00-14.00
Sulphur	0.01
Phosphorus	0.06- 0.10
Iron	to balance

It is made by mixing in a ladle five parts of molten low carbon steel and one part of 80% ferro-manganese; the ferro-manganese has the proper amounts of the other elements to make the percentages given in the above tabulation. The low carbon steel may be made in a bessemer converter, an open-hearth furnace, or in an electric furnace, and there is little or no difference in manganese steel made by any of these processes, whatever may be the virtues of low carbon steel made by one or the other of these processes.

Manganese steel was invented and patented by Sir Robert A. Hadfield in England in 1887 and was first manufactured and marketed in the United States by the Taylor-Wharton Iron and Steel Co. under English and American patents. The owners of the patents did not defend them in this country later, and for several years past patents on manganese steel as such have been public property, although various manufacturers have patented parts and devices made of manganese steel, and the manufacture of it by special processes.

Various manufacturers have adopted and used brand names, some of which are: "Tisco," Taylor-Wharton Iron and Steel Co.; "Amsco," American Manganese Steel Co.; "Era," Hadfield-Penfield Steel Co.; "Diamond," Pettibone-Mulliken Co.; "Rol-Man," Manganese Steel Forge Co.; the latter company being the largest manufacturer and exponent of rolled manganese steel.

There are several good reasons for the relatively high price of manganese-steel parts. The ferro-manganese is an expensive ingredient, the finishing of the castings is expensive because no tool has yet been developed which will work on manganese steel; all finishing has to be done with carborundum grinding wheels; and it was necessary for manganese steel manufacturers to build up extensive accumulations of patterns by actual measurement of parts in the field by engineering salesmen. It is evident therefore that much "overhead" involved in the accumulation of these patterns must be shared by the users of manganese steel.

Manganese steel is very strong in tension (in other words tough), but it is relatively soft and not at all brittle. It can be dented with the peen end of a machinist's hammer, or nicked with a cold chisel, *up to a certain point.* The first blow of the hammer makes a considerable dent, but as the hammering proceeds, less and less impression is made. It grows harder by cold working or impact. This property gives manganese steel its greatest value in the rock products industry, and by far its most popular use is for jaw-crusher jaw plates and steam-shovel dipper teeth, where it is subjected to impact as well as abrasion. In fact impact, or cold working, is really necessary to develop manganese steel's power of resistance to wear; and the absence of impact, pounding, or pressure in most cases accounts for the difference in wearing life of manganese steel parts.

Manganese steel is not so well adapted to parts exposed to repeated stress at or near the elastic limit of the material (which is relatively low), as is nickel-steel or chrome-steel. In parts not properly designed to withstand severe alternating stresses manganese steel fails by fatigue. Hence in replacing cast-steel with manganese steel there are some instances where to develop the best in manganese steel the parts in question should be entirely redesigned. Also manganese steel will fail in some instances by "flowing," that is, failure to retain its shape.

Generally Accepted as a Standardized Metal

Leaving out a large number of users who have had experience with only one brand of manganese steel, or have had too limited an experience to judge, 174 operators are of the opinion that it may be considered a standardized material, with little difference between well-known brands as to quality; 72 operators, however, believe there is a difference—some of them being quite emphatic in this opinion. It is difficult to determine how much weight to give to the opinions of this minority, since there is no way of knowing whether they are making fair comparisons. For instance, from what has gone before, it is obvious that it would be unfair to compare a jaw plate of one brand with a chain of another brand, since the use made of the casting to a considerable extent determines its ability to resist wear and breakage. Also several users believe that there is much difference in the castings turned out by the same manufacturer at different times.

There is, of course, a considerable difference of opinion as to the service rendered by the various manufacturers, but even here it is not fair to judge the manufacturers by service on certain parts as against service on other parts. Obviously some manganese-steel manufacturers are better prepared to give service on specialties than on comparatively rare-order parts. The high cost of the material prevents manufacturers, as well as rock products producers, from carrying large stocks of finished castings.

There is a good opportunity for closer cooperation between the manganese steel manufacturer and the user, as at least one quite prominent user points out. If the user knew the composition and the peculiarities of the particular material in the various castings he uses he would be better able to judge whether it is the metal as a whole, or other factors, that determine its economy for that use. There is also, doubtless, much chance for collective cooperation between the manufacturers and users in standardizing many parts.

General Comments by Rock Products Operators

At the start it should be made clear that most of the comparisons made (and the conclusions drawn) are with ordinary cast steel, low carbon cast steel, and cast iron, and not, unless especially mentioned, with any of the special steels, alloys or materials which have recently been developed for use in rock products plants, such as chrome-

*Metallurgical engineer and superintendent, respectively, of the Taylor-Wharton Iron and Steel Co., Highbridge, N. J., in a paper entitled "Composition and Physical Properties of 12-Per Cent Manganese Steel," American Society for Testing Materials, *Proceedings*, Vol. 24, Part II, 1924.

steel, Strenes metal, or rubber (for chute linings, etc.). Also very few operators keep costs in such detail as to know the actual relative economy of the various materials used in machine or equipment parts; indeed very few of them apparently give it much consideration. Any development that will remove some of the hazard of costly delays at the height of a producing season is regarded as an economy at any price—doubtless correctly since it is hard to estimate the cost of possible delays in a busy season.

There is a distinction also between operators on granite, ganister, trap rock and similar hard, abrasive materials who use manganese steel from sheer necessity, and operators on limestone, sand and gravel, etc., where cast-iron, or cast-steel parts will give at least partial satisfaction. Many hard-rock operators state quite frankly that their operations would not be practicable without manganese steel. A rather unique reason is given by one glass sand producer for the use of manganese steel for jaw crusher plates: "Not only because it is the most durable and economical, but because chilled cast iron and steel plates wear and add too much iron to the product, which must be as free from iron as possible."

Comments by Users

A few big users of manganese steel in the rock products industries have given the matter enough study from the point of view of relative economy, and their comments here are of great value in sizing up the problem as a whole. For example, one of the largest quarry companies with both hard and softer rock operations, which goes into cost-finding as thoroughly as probably any similar operation, expresses this opinion:

"We believe the use of manganese steel in certain of our quarries has added considerably to the wearing life of certain machine parts, and we have suffered less from breakage than before we used this metal. In some of our quarries, however, particularly those of a softer variety of stone, we believe chilled cast iron is more economical to use. We do feel that the wearing quality and strength of manganese-steel castings in those places that we have found adapted to this metal actually does result in fewer interruptions to operations and a corresponding saving of time and labor. There are undoubtedly, however, some places in our various operations and some kinds of stone where we do not feel that it is economy, or that the use of manganese steel at a higher price than steel or chilled iron is economical. It would be difficult for us to point out exactly in general terms where manganese steel may or may not be economical, for we can determine this for ourselves in our own quarries only after a thorough trial and comparisons of cost. There have been instances where we tried manganese steel and have returned to other metal because manganese steel was not economical in that particular place."

An operator of a limestone pulverizing plant, with many years' experience, is a little more specific in attempting to draw the line of when to use manganese steel and when not to use it; he writes: "Our experience with manganese steel has been very satisfactory in every respect, except its very high cost, which prevents us from using it for any repairs save those where the labor cost of replacement is far greater than the cost of ordinary steel parts or good gray cast iron. For repair parts that are easily slipped on without disturbing other parts, ordinary steel or good gray cast-iron parts can be put on half a dozen times or more at less cost than one manganese-steel part."

Another limestone quarry operator of very large experience will not use manganese steel castings of upwards of three tons weight or more because he has found it impossible to weld. Another disadvantage is that manganese steel is non-magnetic and broken parts cannot be kept out of crushers and pulverizers by magnetic pulleys.

The purchasing agent of one of the largest limestone quarrying organizations in the world writes: "Our experience has shown that manganese steel gives a longer wearing life, but we do not think it gives greater freedom from breakage. For this reason we still use some ordinary forged steel dipper teeth, and forged steel hammers for hammer mills. Also we have just started to use Raymond mill beater blades made of a special alloy steel, on account of the short life of manganese steel blades."

A good example of the experience of a large sand and gravel organization is given in the following quotation:

"We operate ladder-type dredges and use manganese-steel sprockets, gears, chains guide wheels, drum wheels, bucket lips, etc. In fact we employ it wherever we have a combination of stress and abrasiveness, for it is the only metal we have found that will stand up under our severe operating conditions. We have been in the sand and gravel business for 25 years and have tried out other metals, or rather used other materials —until we discovered how economical it was to use manganese steel castings. Where strength and ability to resist sudden shock as well as abrasive action of sand and gravel are required, we always use manganese steel; but where only the ability to resist the abrasive action of sand and gravel is required (such as for chutes, liners, etc.) we use the commonest grade of cast iron, having found that it will last as long as manganese steel, while its cost is only one-fourth to one-fifth as much."

A typical instance where the extensive use of manganese-steel parts is considered an absolute necessity is given by a New England hard rock producer, who writes: "All wearing parts in our machines coming into continuous contact with stone are made of manganese steel. This includes steam-shovel dipper teeth and cheek plates for the dipper; in crushers, concaves, heads, wearing plates and chutes are of manganese steel. Our elevators have manganese-steel chain links, rollers, and sprockets. The head and tail rings of rotary screens and also the screen sections up to and including 1¼-in. holes, and practically all gears are of manganese steel. We rate the wearing qualities of manganese steel as compared to other metals as 5 to 1 in some of these parts, and as 10 to 1 in extreme cases. In some cases manganese steel is the only thing practicable when heavy stress, as well as wear, is a factor to be considered."

Another hard rock producer (trap rock in this case) writes: "We are using manganese steel on the following machinery: Screens, both head and tail casting tires, and screen plates, gyratory-crusher mantles and concaves, jaw-crusher plates, cheek plates and toggle bearings. Our experience has been that manganese steel gives much longer wearing life and consequently freedom from interruptions. In our particular service we would say that manganese steel is 50% better than chilled cast iron. We feel that manganese steel has helped us considerably in maintaining steady operation, which naturally means labor saving and final economy."

Still another trap-rock producer (West Coast) writes: "We have used manganese steel for more than 20 years, and in its place there is no metal which is as satisfactory so far as our experience goes, although we have tried other alloy steels, and many grades of cast iron and steel for the same purposes. The question of relative cost comes in, which is so much of a variable that it is very hard within the limits of a brief letter to say what is the most economical metal to use in many cases."

A lime manufacturer writes: "There are probably many places where manganese steel should be used, but most plant managers are so busy with routine that unless the substitution of manganese is suggested for each specific use, it may be a long time before the metal is adopted where it should be." The best answer to this is the following catalog of the uses of manganese steel, and the experience of users of these particular parts.

Uses of Manganese Steel Cataloged

BALL MILLS—Balls, both wet and dry (cement)—"Will outlast cast iron or steel." *Breast plates* (cement)—"Much longer wearing life than carbon steel; no stronger than other steels; resistance to wear greatest factor." "Better in most cases." "Very much greater life." *Liners* (cement)—"Better service than some materials; good charcoal chilled cast-iron will give manganese steel a hard run on cost of production (of cement) basis." "Very much greater life." "Always gives longer life and greater freedom from breakages." "Tendency to flow is a distinct disadvantage; nevertheless manganese steel is justified because of uninterrupted production." "Warping makes removal necessary before wearing out." *Pinions* (feldspar and cement)—"More eco-

nomical than any other metal." "Resistance to wear most important factor."

BEVEL PINIONS, on steam-jacketed kettles (phosphate)—"Life increased from six weeks to 18 months."

BRADLEY MILL parts (limestone)—"No doubt about economy."

CABLEWAY EXCAVATOR BUCKET TEETH (sand and gravel)—"Longer wearing life than high carbon steel." "Give extremely good satisfaction, one set used four months with very little wear." "Lasts three times as long as steel."

CABLEWAY EXCAVATOR BUCKET LIPS (sand and gravel)—"My experience shows manganese steel will last ten times as long as steel." "On ½-yd. bucket manganese steel lasted five months, forged steel lasted three weeks." "There is no question of superiority of manganese steel over plain cast steel or forged steel; the first cost counts for nothing compared with advantage of minimum delay."

CABLEWAY EXCAVATOR BUCKET SHOES (or runners) (sand and gravel)—"Lasted no longer than original runners." "Lasted three times as long as steel."

CABLEWAY EXCAVATOR SHEAVES (sand and gravel)—"Formerly had much trouble from rapid wear; now sheaves take on a high polish that also reduces friction." (See also *SHEAVES.)*

CAMS, on shaker screens (core sand)—"Have cut down repairs considerably."

CHAIN (elevator, drive, etc.) (all rock products plants—returns from 92 producers summarized)—"For open drives in dusty places manganese-steel chain is the only kind worth installing." "Particularly gratified by experience" (limestone). "Can't say it wears longer, but there is less breakage" (sand and gravel). "In sand-settling tanks it lasts twice as long as steel and does not break." "From 50 to 100% longer life" (sand and gravel). "Lasts two to three times longer than steel" (sand and gravel). "Manganese steel lasts three times longer than case-hardened steel, five times cast iron" (cement products). "Will outlast steel several times" (lime). "Satisfactory and much better than other metals" (lime). "Economical in every instance where abrasion is met" (cement). "Absolute satisfaction" (granite). "Much longer life—sometimes four to five times; can't afford not to use it" (granite). "Lasts two or three times as long." "Outwears and gives less trouble than steel" (silica). "Wears about four times as long as steel" (limestone). "Replaced a belt drive on revolving screen (limestone), that had caused a lot of trouble; chain in service four or five years and no trouble." "About three times wear of malleable iron" (trap rock). "Experience proves manganese steel most economical" (sand and gravel). "About four times life of steel" (sand and gravel). "Difference in cost more than made up." "No comparison with malleable iron or soft steel." "Won't stand shock." "Several times' wear of malleable iron or mild steel; don't use manganese pins, they break too easily" (cement). "Two times' wear of ordinary chain" (sand and gravel). "Only practical metal" (granite). "Three times' life of other chain" (cement). "On elevator handling clinker and cement, much better service and have reduced breakage approximately 50%." "About three times' life of steel—substantial saving of time and labor" (sand and gravel). "Handling clinker malleable-iron elevator chain lasted eight months; manganese steel three years shows little wear." "Extra cost justified; three to four times life of ordinary steel or malleable iron" (cement). "One to two times life of ordinary steel chain" (cement). "Less breakage and five times longer life" (limestone. "Unquestionably better, but can give no satisfactory comparison" (sand and gravel). "Steel gave constant trouble; no trouble with manganese steel" (sand and gravel). "Very economical on hot cement clinker." "Tool steel, oil-tempered, gives better service in some instances" (cement). "About three times life of steel chain" (cement). "Two to three times life of ordinary steel" (lime). "Far superior to malleable iron" (limestone). "We have had a conveyor chain operating 24 hours a day on sand and gravel for the past year, prior to that time malleable-iron chain would last about six weeks—would have nothing else." "Less breakage and five times the wear in conveyor chain" (lime). "Ordinary chain lasts 11 months; estimate manganese steel chain life three years" (fertilizer).

CHASER-MILL WEARING PLATES (silica)—"Experience shows manganese steel gives less trouble and outwears other metals." "For tires and bottom plates it sure is a wonderful metal; without it or something equally good would be almost useless to try to operate some of our equipment." "Wears much longer than cast steel and saves a great deal in labor of renewals."

CHUTES AND CHUTE LININGS (45 users)—"Undoubtedly wears longer." "Very marked saving." "Four to five times' wear of cast iron or steel." "Put in 10 or 12 years ago, replacing chilled cast iron which wore out in five years." "Five times' longer life than cast iron or steel." "We are strong for it; costs money and saves money." "Unquestionably better but can give no comparisons." "Don't see how we could operate without it." "Five times' life of case-hardened steel." "Four to five times' life of cast iron." "Will outwear other metals two to one." "Four times' longer than cast iron." "Only thing to use; wears indefinitely compared with cast iron; 500 to 1000 tons of limestone a day for three years, wear very small." "If we were to redesign our plant we would put in all manganese-steel liners."

CLAMSHELL BUCKET LIPS (19 users)—"About four times' life of steel." "Very much greater life." "Believe about two or three times' longer wear than steel." "Considerably longer service; have not had a breakage in five years." "No economy in use of manganese steel." "Will stand abrasion of sand." "Four times' wearing life of other metals used, very little danger of breakage." "Absolutely necessary." "Two to three times' wear of steel or iron."

COMPEB-MILL FEED TUBES (cement)—"Better than cast steel or cast iron."

COMPEB-MILL GRINDING PLATES, Screens, Heads, etc. (cement)—"Entire satisfaction." "Never use anything else."

CONCRETE-BLOCK MACHINES, Liners, etc.—"Six times service of steel." "Cast steel lasts only three months."

CONVEYOR GUDGEONS (cement)—"All right under certain conditions but it cannot be used for handling hot material." (See also *CHAINS*, Elevator, etc.)

DERRICK SHEAVES—"Outwear ordinary sheaves but wear on cables is greater." From two to three times longer wear and less breakage." "Have used 15 years and never replaced them" (granite). (See also *CABLEWAY EXCAVATOR SHEAVES.)*

DRAG-LINE BUCKET FRONTS AND LIPS—"Last much longer." "Ordinary steel patches wear like lead compared with manganese steel." "Two to three times life of other steel or iron." "A wonderful time saver."

DRAG-LINE BUCKET TEETH—"Only metal that will stand up." "Far superior." "Last much longer." "Know they have longer wearing life." "Find nickel-chrome steel gives as good service as manganese steel, is cheaper, and can be drawn out." "More than repays extra cost of other steels not counting freedom from delays." "Do not like manganese steel as we do not get proper results in resharpening." "Wonderful metal."

DRAG-LINE ROLLERS, SHACKLES, SHEAVES—"Continual breaking of shackles has been practically eliminated by use of manganese steel." (See also *SHEAVES.)*

DRAG-SCRAPER BLADES—"Some break before they wear out; others stand up fine."

DREDGE-BUCKET CHAINS—"Longer life than ordinary or alloy steel chains—three to four times as long." "Two to three times longer life." (See also *CHAIN.)*

DREDGE BUCKETS—"Longer life by three or four times than steel."

DREDGE PARTS—"Use nothing else on 24-hr.-a-day operation; malleable iron parts lasted about six weeks."

DRYER TRUNNIONS—"No comparison with other metals; have replaced cast-iron and rolled-steel trunnions that wore out in six weeks; manganese steel has been in three years and going strong."

ELEVATOR PARTS—"On head shaft formerly used two gears and two pinions, which rarely lasted one season; one set of manganese gears and pinions give two to three seasons' wear." "No more trouble since using manganese steel wherever possible." "Absolute satisfaction for buckets

handling granite." "Only metal giving satisfactory service in large alkali plants." "Two to three times' longer life." "Cast-steel lasted only three months." (See also *CHAIN*, elevator, etc.)

FLAP VALVES on dredge pipe line.

FULLER-LEHIGH MILLS—Balls; "No comparison, satisfied as to economy." *Grinding rings;* "Just installed."

GEARS AND PINIONS (28 users)—"Last longer—no data." "Almost obligatory to use manganese steel; cost of cast-iron and cast-steel gears prohibitive because of breakage" (trap rock). "About four times' wear of steel." "Very marked saving in dusty places." "Four to five times' longer life; can't afford to use anything else" (granite). "Unquestionably better." "Result in fewer interruptions, saving of time and labor, especially where many other parts must be moved." "Not recommended for crane gears—it breaks." "For turning engine on dredge, good results under very hard service." "Cast-iron gear in dusty place lasted three months; manganese steel two years." "Do not give good economy." "Longer wearing life and greater freedom from breakage." "During the past few years we had considerable difficulty keeping cast-steel bevel gears in No. 9 McCully gyratory crusher. The expense and inconvenience became so great that in January of this year we had one of these gears cast of manganese steel. It has been in since that time and we do not hesitate to state that we believe it will last for several years. The service from the cast-steel gears varied from 12 hours to seven or eight months (on very hard rock). Manganese-steel manufacturers have not played up the saving from the use of gears and pinions sufficiently." "About 12 times the life of cast-steel which lasted only 30 days on gyratory crusher working granite." "Have eliminated considerable delay in crusher replacements." "Decidedly economical especially for crusher gears to avoid breakage where there is considerable vibration." "Two to three times longer life on steam-shovel gears." "Most economical metal to use for steam-shovel gears where hard service is required." "Installed 90-tooth 10-in. face tube-mill gear with pinion to match; from present observations cost will be justified; cast-iron gears in same place lasted three months" (cement). "Bevel gears on scalping screen; standard gears were replaced two or three times a season; manganese steel good for two seasons" (trap rock).

GRIZZLIES—"Boiler steel lasted six months; manganese steel two years." "Only practicable metal for granite." "Good economy for slag."

GYRATORY CRUSHER CONCAVES (127 users)—"From two to three times' life of ordinary steel; three to four times chilled cast-iron" (limestone). "Adds 100% to life" (gravel). "Far superior to anything else" (gravel). "Two to three times life of chilled cast-iron" (limestone). "Only practicable metal for granite." "About four times' life of chilled cast-iron, in case the cast iron does not break; two to two and a half times' life of carbon steel" (granite).

"Anything else out of the question" (granite). "Experience of many years proves beyond doubt manganese steel is the cheapest" (limestone). "Four to eight times life of chilled cast iron or common steel" (limestone). "Four to five times life of cast iron" (limestone). "Outlasts two sets of cast iron" (limestone). "Long experience shows five times life of chilled cast iron" (limestone). "Absolutely necessary" (granite). "Undesirable tendency to flow" (gravel). "Our previous replacements were chilled cast iron and necessary every season; have used manganese steel two seasons; looks good for two more; ultimate cost considerably lower than chilled cast iron; crusher product more uniform because manganese steel wears slower, hence less need of adjustments" (limestone). "Impossible to use anything but manganese steel; never did; positive our hard flint would wear away cast iron in a few days." "Most instances wears 3 to 1 longer than cast iron" (limestone. "About 100% longer life" (limestone). "To best of our knowledge manganese steel has life 3 to 10 times life of ordinary steel." "Very marked saving" (limestone). "Four to five times wear of anything else" (granite). "Three to five times longer wear" (gannister). "Universally satisfactory on very hard gravel; other steel tried cut out quickly, necessitating changes at heavy expense." "Nothing so good in 20 years' operating experience" (limestone). "Far better than any other metal I have used" (gravel). "Gives longer wearing life and greater protection from breakage than cast iron or steel; on account of toughness of our stone (granite) saves many replacements." "Rapidly standardizing on manganese steel" (limestone. "Chilled cast iron lasts 6 months; manganese steel 5 to 6 years" (limestone). "Lasts two or three times longer" (limestone). "Less breakage and five times longer life" (limestone). "Good metal but castings do not fit well enough." "Tried manganese steel and gave it up because it wore in holes; as soon as it started to wear it wore very rapidly; also objectionable because of being 'slippy'; returned to use of chilled cast iron" (limestone). "Getting better service with less expense than nearby plants using cast-iron parts" (gravel). "Experience proves manganese steel is the most economical" (gravel). "Four times life of cast steel (limestone). "Don't see how we could operate without it" (trap rock). "About double the life of cast iron or steel" (limestone). "Manganese steel has never broken; chilled cast iron broke frequently" (lime stone). "Formerly renewed concaves every year; manganese steel on five years and still good" (limestone). "More serviceable; superiority has been practically demonstrated; of inestimable value to crushing trade" (silica). "No comparison between manganese steel and chilled cast iron; have no definite records but know manganese steel parts have greatly outlasted gray iron and steel castings they replaced" (limestone). "Chilled cast-iron concaves lasted one year; manganese steel five years and no appreciable wear" (refractories).

GYRATORY CRUSHER HEADS (72 users)—"Four to five times wear of cast iron or steel" (limestone). "Two or three times life of chilled cast iron" (limestone). "Anything else out of question" (granite). "More than twice the service and does not break" (gravel). "About double the wear of cast iron or steel and does not break" (limestone). "Changed from manganese steel to chilled cast iron because of the tendency of manganese steel to flow under pressure and break threads in lock nut" (granite). "Installed several years ago; satisfactory service; still in use" (gravel). "Three times life of ordinary steel, and gives a substantial saving of time and labor" (gravel). "Two to three times life of steel" (slag).

GYRATORY CRUSHER MANTLES (87 users)—"Would not consider anything but manganese steel" (granite). "Outwears chilled cast iron by 50%" (trap rock). "Only metal practical or dependable" (granite). "Gave up using manganese steel because of trouble keeping mantles fast on cores—now use chilled cast iron" (gravel). "Unquestionably better" (gravel). "Most instances life 3 to 1 compared with cast iron; in some instances better" (limestone). "Four to five times longer wear than cast iron" (limestone). "Two to three times life of chilled cast iron" (limestone). "Unquestionably longer life and freedom from breakage" (gravel).

GYRATORY CRUSHER SPIDERS (2 users)—"Will last at least five times as long as cast iron or steel; used one for 15 years without showing any appreciable wear" (limestone).

HAMMER MILLS (and pulverizers, including American, Jeffrey, K-B, Gruendler, Kent, Pennsylvania, Sturtevant, Williams, and unnamed ones.)—*Hammers* and *Beaters* (51 users)—"Positive saving" (paint pigment). "Gives longer life and greater service" (pyrites). "Great economy." "Three times length of service of hammers originally used" (limestone). "Double service of hammers previously used" (shale). "Far superior to ordinary steel hammers; our particular difficulty was tendency of the hammers to shear off at point where lug engaged the disk; greatly improved by use of manganese steel" (alum cake). "Outwear and give less trouble than steel" (silica). "About 4 times wear of steel" (limestone). "Manganese steel did not stand up" (gypsum). "Will outwear white iron castings 3 to 4 times" (cement). "Slightly longer life" (gravel). "Special cast iron lasts five times as long as manganese steel—small mill, little experience" (cement products). "Have worn them out" (limestone). "Stand up very well" (gypsum). "Very satisfactory" (lime). "Much superior to ordinary steel" (lime). "Last two or three times

longer than other hammers" (marl). "Twice as long as ordinary hammers" (fertilizer). "Welded manganese steel no better than good high carbon steel" (limestone). "Wear about three times as long on flint as mild steel and do not break." "Giving better service than chilled cast iron" (cement). *Grinding plates*—"Much better service than chilled cast iron" (cement). *Screen bars*—"Have longer wearing life and greater freedom from breakage" (marble). "Only metal practicable and dependable" (bone meal). "Double service of steel originally used" (shale). "Lasts longer in most cases" (cement). "Very satisfactory" (lime). "Does not stand up any better than ordinary steel" (gypsum). "Tougher and more wear" (cement). "About four times longer wear" (limestone). "Three times length of service of bars originally used" (limestone). *Roll heads* (ring-roll type of mill)—"Did not give same amount of service secured from chilled cast iron" (cement). *Rings*—"Will outlast any metal tried" (silica).

JAW CRUSHER CHEEK PLATES (21 users)—"More economical than any other metal" (feldspar). "Cast iron lasted two weeks, manganese steel 6 months" (basalt). "Nothing tried equals it" (trap rock). "Other metal would be out of the question" (granite). "Lasts five times as long as case-hardened steel" (limestone). "Wears longer; cast iron lasts a month" (ganister). "Possibly 200% longer life" (trap rock). "About a 3 to 1 life over cast iron or steel, at 20% greater cost, but freedom from interruption amounts to many times cost of castings" (trap rock). "Have not found any grade of steel that compares with manganese steel" (gravel).

JAW CRUSHER JAW PLATES (147 users)—"Cast iron lasted 30 days, manganese steel still good" (ore). "Double wear of cast iron or steel; fewer interruptions" (limestone). "Chilled cast iron lasts 2 weeks, manganese steel 6 months" (trap rock). "Chilled cast iron lasts 2 weeks, manganese steel 30 to 60 days" (ore). "Cheaper in long run" (granite). "Used several years and shows no appreciable wear" (trap rock). "No doubt about economy" (granite). "A wonderful time saver" (gravel). "Steel replaced every three months, manganese steel lasts over a year" (limestone). "Four to eight times life of common steel or chilled cast iron" (limestone). "Five times life of case-hardened steel" (limestone). "Cast iron lasts only one month" (ganister). "Hardest rock to crush in the United States—four years without breakage" (granite). "Three to five times longer wear" (ganister). "Very hard stone and no breakage in 8 years" (trap rock). "Have had chilled cast iron plates crack in 24 hours' service" (limestone). "Wears a great deal longer; have used both manganese steel and chilled cast iron; found manganese steel most serviceable" (basalt). "Experience shows manganese steel far superior to other metals" (limestone). "Universally satisfactory; material crushed very hard; manganese steel only metal that will stand up; other steel cut out quickly requiring frequent replacements" (gravel). "Crushing very abrasive material; manganese steel stands up well; believe it pays" (silica). "Nothing could take its place; four times more wear than other metals; no interruptions due to faults of manganese steel" (gravel). "My outfit is small, but I have had a very good opportunity to test manganese steel by crushing 'hard heads' from the river bed; the jaws must stand up" (gravel). "Satisfactory on primary crusher, unsatisfactory on 8x36-in. recrusher; plates wear out with from 2865 to 4212 cu. yd." (gravel). "Will crush 50% more material than high carbon steel" (slag). "Wears twice as long" (abrasives). "Breakage of manganese steel parts is very rare; lasts six times longer than chilled cast iron and three times longer than chrome steel; fewer interruptions; first cost fully justified by longer life and saving in replacements" (abrasives). "Would consider no other material" (rock asphalt). "Six times longer service" (cinders). "From 50 to 100% longer life" (gravel). "Three to four times life of chilled cast iron" (gravel). "Four times life of chilled steel; twice life of chrome steel" (quartz). "Plates made of good car-wheel scrap iron by local foundries last as long as manganese steel" (ore). "Semi-steel plates last about one-sixth the life of manganese steel; high carbon steel not as satisfactory" (slag). "Two to three times life of chilled cast iron" (limestone). "Find a white cast steel cheaper on small equipment" (limestone). "Had considerable and several interruptions from breakage with regular plates on 60x48-in. crusher; manganese-steel plates in continuous service 20 months without any trouble" (limestone). "Harder, lasts longer and is a great deal more economical than ordinary commercial castings" (limestone). "Three to four times wearing qualities of chilled cast iron; two to three times ordinary steel" (limestone). "About twice the life of chilled cast iron" (limestone). "Much more strength and wearing resistance, possibly 100%" (limestone). "Had no breakage in five years' (limestone).

JAW CRUSHER TOGGLES (and *toggle bearings)*—"Pays to use manganese steel" (ganister). "Very much longer life, sometimes four or five times; can't afford to use anything else" (granite). "Most economical metal to use" (gravel).

KOMINUTER BREAST PLATES, Discharge grates, grinding plates—"Much longer life than carbon steel; no stronger than other steels; resistance to wear most important factor" (cement). "Never use anything else" (cement).

LADDER DREDGE PARTS (14 users)—"Hemispherical buckets of 2-cu. ft. capacity, screens 48-in. by 12-ft., trunnion wheels and riding rings; buckets have bushings and pins of manganese steel; used six weeks and shows no signs of wear, but have broken two pins, probably due to poor annealing; even this brief experience has proved value of manganese steel for screen trunnions and screen plates" (gravel). "Bucket chains in constant use 4 years; steel chain lasted 3 to 4 months" (gravel). "Sprockets, gear, chains, guide wheels, drum wheels, bucket hips, etc.; use manganese steel wherever possible" (gravel). "For river dredges with bucket ladders, clamshells, crushers, screens, hoisting equipment, etc., manganese steel is used for bucket-chain links, wearing plates for chutes, concaves and mantles for crushers, screen plates, bearings for outboard hoist drums, screen heads and tires combined, screen trunnions, spray pipe bushings in screens, scrubber baffles, horn-wheel teeth" (bucket chain sprocket); in our opinion manganese steel is best for any sand and gravel plant that runs day and night and produces not less than 150,000 tons per month; it cannot afford to shut down to overhaul the main bucket line until the winter months, and even then 'they have to make it snappy'; we have been using manganese steel screen heads without tires for five years and the wear is ¼ in.; with steel the wear would be 2½ in., or three sets of tires; all bucket links should be surface ground on the face that bolts to the buckets to keep them from rocking and turning."

LOCOMOTIVE HEADS AND PINS—"Outlasts ordinary steel 4 to 5 times." (See also *chain, gears, sheaves.)*

LOG-WASHER LUGS—"Good economy" (paint pigment).

MOTOR-TRUCK FRAMES—"Have found nothing as satisfactory" (gravel).

PADDLES IN MIXERS—"Service particularly severe" (carbon).

PIPE (Dredge, both cast and rolled)—"No comparison." "No records but noticeably in favor of manganese steel."

PIPE BENDS, DISCHARGE, ELBOWS, FLANGES, NIPPLES—"Two or three times longer life." "We used gray cast iron elbows and common steel nipples; replaced these with manganese steel; no further replacements necessary; found pipe line wore out in certain places very rapidly and the time lost in replacements cost us many times cost of manganese-steel parts, not counting loss of production; should specify elbows be made ½-in. full on inside, where metal wears; it is my experience that manganese-steel elbows made in this way will outwear common cast-iron elbows 6 to 10 times; we are replacing wearing parts with manganese steel as fast as old parts wear out." "Flanges wear two to three times longer than cast iron."

POT-CRUSHER KNURLES—"Grinding caustic soda."

PUG-MILL BLADES—"Stand abrasive wear of clay and are much tougher than cast iron."

PUMPS, PUMP RUNNERS, SHELLS, ETC. (43 users)—"Handling cement slurry—very much longer life." "For pebble phosphate, economical, good field for development." (Following are all sand and gravel producers' comments.) "Operated 18 months, approximately 60,000 yd. of sharpest kind of

granite gravel." "Gives about five times' wear of ordinary cast iron." "Unquestionably better but no satisfactory comparison." "Lasts about five times as long." "Have used cast-iron and cast-steel shells and impellers, and have worn them out on our dredge in 71 hours; a managese-steel impeller lasts about three months under the same conditions; in our experience there is no comparison." "Experience has shown about three times' wearing life of cast-iron pumps formerly used." "We have used manganese pump parts since 1913, having used plain gray cast iron and cast steel; the cast steel gave only slightly longer wearing service of the two; these pumps would give out all at once without outward warning, cracking or breaking entirely; manganese-steel gives about 200% more wearing service and does not fly to pieces; can also be used with temporary repairs after showing outward signs of failing." "About double the life of cast iron." "Costs about three times as much and wears about three times as long as cast iron." "Cast-iron pumps handled 1500 to 2000 yd.; manganese-steel pump 4000 to 6000 yd., before failure." "Impellers about 4 to 1 better than steel." "Lining has four times' life of steel." "Ordinary cast-iron pump shell lasted 3 months, manganese steel about one year." "Twice as long service as steel." "Cast-iron shell wore through in 100 hours; manganese steel has gone several thousands hours and shows little wear." "Double the life of standard castings." "Manganese impeller outwears three of cast iron." "Runners produce three times as much material as grey cast iron or semi-steel."

QUARRY-CAR TRUCKS—"Wears longer and no breakage." "Very best of service, show very little wear, much superior to trucks formerly used."

QUARRY-CAR WHEELS—"Experiment-breakage make cost of ordinary wheels prohibitive." "In use two years and show no signs of wear." "Outlast other metals and give less trouble." "In service 20 years and still good; had to renew chilled cast-iron wheels about every six months." "Wear longer and no breakage."

RAYMOND MILL PARTS—"Rolls and rings—better service and less breakage" (magnesite). "Better service on gears and pinions, grinding coal, than malleable, cast, steel or cast iron" (cement). "Much superior to straight carbon steel castings for beater blades; no breakage" (lime). "Greatly increased length of life, and castings are freer from flaws than ordinary cast-steel" (rock phosphate). "For bull ring—superior to ordinary steel; better and more uniform wear" (graphite). "Recently started to use blades made of special alloy steel on account of short life of manganese steel" (lime). "Manganese-steel beater blades show considerable wear, serious rounding of corners, etc., after only about 300 tons run—would indicate replacement every 30 to 60 days" (lime). "Blades have two to three times wearing life of ordinary steel" (lime). "Considerable longer wearing life on blades; have not had a breakage in past five years" (lime). "Two to three times wear of ordinary steel" (lime). "Four times length of service on ordinary steel blades" (gypsum). "Know of other plants where they claim hard carbon steel makes better fan blades, but we find here manganese steel is best" (gypsum). "Does not stand up any better than ordinary steel" (gypsum). "For liners castings are fairly satisfactory but castings are a bad fit" (lime). "Manganese-steel plow points last longer" (talc). "Better service on plow points than cast steel" (cement). "Plow points outwear white iron castings three or four times" (cement). "Rolls stand up very well" (gypsum).

ROD-MILL HEADS—"Boiler plate heads lasted six months; third season for manganese steel, still good" (sand-lime brick).

ROLL CRUSHER PLATES—"Economical on rock phosphate."

ROLL SHELLS (26 users)—"No breakage in eight years on very hard rock" (quartz). "Four to five times life of cast iron" (limestone). "Experience shows manganese steel outlasts other metals and gives less trouble" (silica). "Four to eight times life of chilled cast iron or common steel" (limestone). "Crush 75% more material from 1¼ to ⅝-in. than shells of tire steel in the same service" (limestone). "Five times longer life than case-hardened steel" (limestone). "Four to five times life of cast iron or steel" (coke). "Less breakage and five times the life" (limestone). "Gave up use of manganese steel because it wore too 'slippy' and would not grip the stone; went back to use of chilled cast iron" (limestone). "Wear twice as long" (abrasives). "Breakage very rare, six times life of chilled cast iron" (abrasives). "Consider manganese steel so far ahead of ordinary steel or chilled cast iron never considered comparison necessary" (abrasives). "Where great strength is not required and castings can be extra heavy, find chilled cast iron will give better service" (slag). "Good car-wheel scrap cast by local foundries lasts as long" (ore). "Possibly 200% greater wear" (lime).

ROTARY CRUSHERS—"Economical" (gypsum). "Not equal to chilled cast iron" (lime).

SAND-HANDLING PARTS—"Where wet sand is handled have found abrasion was best prevented by what is locally termed gray brake-shoe steel."

SAND-LIME BRICK PRESSES—"Cast-iron table had to be planed smooth every year, or new tables installed; third year with manganese steel and still good."

SAND WASHING BOXES—"Sprockets and chain—used No. 730 chain and flight attached every other link; a malleable iron chain required two full length replacements a year; this year began using manganese-steel chain same pitch but heavier construction; after year's use shows little wear; expect to get three years' use before renewal; malleable-iron chain cost 39% of cost of manganese steel; on this basis of comparison the ultimate cost of manganese steel is approximately 43% of that of the malleable-iron chain." "Sprockets and chains wear 50 to 100% longer."

SCREENS (Rotary—Plate sections—81 users)—"Three times longer life than steel, substantial saving of time and labor" (sand and gravel). "Only six weeks' service proved value" (sand and gravel). "Adds 100% to life" (sand and gravel). "Almost obligatory to use manganese steel" (trap rock). "About double life of steel" (limestone). "About 100% better than ordinary tank steel in larger sized perforations" (trap rock). "Don't see how we could operate without it" (trap rock). "In service 16 years" (limestone). "Wears four times longer than steel" (slag). "Outwears several plates of steel—most satisfactory and economical" (rock asphalt). "Outlast ordinary steel plates 3 to 1" (trap rock). "Experience leads to belief it is absolutely necessary for hard or abrasive material" (limestone). "Five times life of steel—castings too rough around the holes" (limestone).

SCREENS (Wire)—"Five times life of steel" (limestone). "Did not wear enough longer than steel to warrant additional cost" (slag). "Four times as long wearing life as steel" (slag). "One-third worn away in 30 days" (granite). "Extremely satisfactory" (limestone). "Four to five times longer life than steel" (granite).

SCREEN HEADS, RINGS, ROLLERS, TRUNNIONS—"Heads last two or three times longer than steel" (limestone). "End casting unquestionably better" (sand and gravel). "Formerly had much trouble with wearing ring at head of screen wearing to form flat places; have used manganese ring three years without appreciable wear; wear gives high polish and reduces friction" (sand and gravel).

SCREW CONVEYOR GEARS, GUDGEONS, FLIGHTS—"Gears last five to six times longer than cold-rolled steel" (cement). "Gudgeons have much longer life than carbon steel; no stronger" (cement). "Flights last longer in most cases" (cement). "Very much longer life" (cement). "Entire satisfaction" (cement). "Always give longer life and greater freedom from breakages" (cement).

SHEAVE BLOCKS, FRAMES—"We used on an average one sheave a day until we installed manganese steel, besides losing nearly an hour a day for greasing; now we grease once a month and have not used up or repaired a sheave in eight months" (sand and gravel). "Cast-iron lasted six months, manganese steel lasts indefinitely" (basalt). "Ordinary steel will not stand up" (granite). "Main sheaves on 3-yd. drag scraper had to be replaced in from 3 to 4 days; manganese-steel sheave on same pull in good condition after six weeks" (sand and gravel). "On tramway bucket handling sand; stands up better than any other metal."

(See also *CABLEWAY EXCAVATOR SHEAVES; DERRICK SHEAVES.*)

SKIP CAR WHEELS—"Cast-iron wheels last about 30 to 60 days; manganese steel last 3 or 4 years, or longer" (gravel).

SLUGGER ROLL SHELLS—"About 50% more material crushed than high carbon steel" (slag).

SPRING SCRAPER BLADES (under truck on road work)—"Lasted longer but extra cost made results the same."

SPROCKETS (Elevators, Conveyors, etc.—32 users)—"Four to five times life of cast iron or steel" (coke). "Less breakage and five times the life" (limestone). "Not satisfactory because they cut out steel chain very fast" (sand and gravel). "Difference in cost more than made up in longer wear and fewer interruptions to operation" (sand and gravel). "Have found no substitute; at least four times life of any other metal" (sand and gravel). "Strongly in favor of manganese steel because of saving from interruptions" (limestone). "About four times longer wear" (limestone). "Very marked saving in dusty places" (limestone). "Four to five times longer wearing life; can't afford to use anything else" (granite). "No doubt about economy" (limestone). "Satisfactory and much better than other metals" (lime). "In operation 24 hours a day for a year; cast steel lasted about six weeks" (sand and gravel). "Will outlast iron or steel several times over" (lime). "Under certain conditions manganese steel lasts ten times longer than cast iron sprockets" (paint pigments). "Last longer and save labor" (glass sand).

STAMP MILL CAMS AND TAPPETS—"Other cams and tappets seemed to crystallize and break under service required; manganese steel almost indestructible under same service" (ore).

STEAM-SHOVEL CLEVICES—"Most economical metal to use" (sand and gravel).

STEAM-SHOVEL DIPPERS—"Almost obligatory to use manganese steel" (trap rock). "Five times longer wearing life than other metals" (limestone). "Outlast ordinary steel by far" (limestone). "Double life of cast iron or steel; fewer interruptions" (limestone). "Little wear at end of second season" (limestone). "In some instances four to five times life of steel" (limestone). "Three to four times life of steel" (limestone). "Where corners wore out and ordinary steel patches were used patches lasted only one month; manganese steel dipper has already served six months and will probably last six months more" (granite). "We have used manganese-steel dipper fronts, lips and teeth; generally satisfactory but we have had trouble with dipper lips and fronts cracking very soon after installation; these defects are apparently due to defects, not to wear; have abandoned use of manganese-steel fronts; we now build up fronts of rolled carbon steel plates and use manganese-steel lips and teeth" (limestone).

STEAM-SHOVEL DIPPER FRONTS (70 users)—"About 100% longer life" (limestone). "Lasts two or three times longer" (limestone) "Never had manganese-steel wear out but have had to replace on account of breakage" (limestone). "No records but results are noticeably in favor of manganese steel" (sand and gravel). "Always gives longer service and no breakage—'once used never refused'" (limestone). "Three to five times wearing life; extra cost repair three-fold" (limestone). "Economy obvious" (cement). "Already has outworn four or five ordinary dipper fronts and is apparently as good as new now" (limestone). "Ordinary dipper lasts only one season; manganese-steel dipper has already lasted three seasons" (trap rock). "One manganese-steel dipper in use 11 or 12 years; good for as much more" (limestone). "Experience of many years shows manganese steel is beyond doubt cheapest" (limestone). "No other metal has stood wear like manganese steel" (sand and gravel). "Very economical" (cement). "No question in my mind as to advantage" (limestone). "Outwear several old type" (slag).

STEAM-SHOVEL DIPPER LIPS (43 users)—"Less breakage and 100% longer life" (limestone). "Much superior wearing qualities" (limestone). "No metal to compare with it in 20 years' operating experience" (sand and gravel). "Longer wear and better service than steel" (limestone). "Longer wearing life but not greater freedom from breakage" (limestone). "Two or three times longer life than steel" (slag). "Longer life in some instances, but stopped using because lip and front opened" (cement).

STEAM-SHOVEL DIPPER TEETH (161 users)—"Longer life and less breakage" (sand and gravel). "Wear longer; have never broken one" (silica). "Cut repair cost at least 50%" (sandstone). "Three to five times longer life" (trap rock). "Two or three wore out; have had to renew several on account of breakage" (limestone). "Inclined to believe manganese steel more satisfactory; up to this time have never worn out any dipper teeth" (limestone). "Have never broken a manganese-steel tooth; forged steel did break" (limestone). "Would not consider anything else" (granite). "Four times life of any other metal and very little danger of breakage" (limestone). "Cheaper in the long run" (trap rock). "Only one instance where forged steel proved better—on a very tough stone." "Double the service" (limestone). "Forged steel better because of tendency of manganese steel to flow" (granite). "By far the cheapest" (limestone). "Very much greater life" (cement). "On highly abrasive material (silica) teeth have served remarkably well." "Longer life and it pays to use it; not so satisfactory though as in pumps" (sand and gravel). "Much more strength and wearing resistance, possibly 200%" (limestone). "Gives some longer life but best feature is reversible design" (sand and gravel). "Show less wear after 30 days than common steel in 3 days" (sand and gravel). "Do not like it in dipper teeth as we do not get proper results after resharpening" (sand and gravel). "Have tried other metals, manganese steel best" (slag). "Gives longer wearing life but not greater freedom from breakage; therefore still use some forged steel teeth" (limestone).

STEAM-SHOVEL CHAINS—"Outlast ordinary steel 4 to 5 times" (gravel).

STEAM-SHOVEL BOLSTER AND TRANSOM FRAMES—"Life two or three times ordinary steel" (limestone).

STEAM-SHOVEL DIPPER STICK RACKS AND PINIONS—"Have replaced manganese steel with vanadium steel because of breakage" (limestone). "Manganese always gives double service and no breakage" (limestone). "Practically permanent; wear and breakage very small compared with chilled cast iron or steel" (limestone). "Much greater strength and resistance to wear" (limestone).

STEAM-SHOVEL PINS—"Outlast ordinary steel four or five times" (sand and gravel). "Most economical metal to use" (sand and gravel).

SWINTEX NOZZLE (for suction dredges)—"Much longer life" (sand and gravel). "No particular advantage over steel" (sand and gravel).

SYMONS DISC CRUSHERS (backs, bolt shields, grinding plates, discs)—"Have never found any grade of steel to compare with manganese steel" (sand and gravel). "Undoubtedly wears longer" (sand and gravel). "Unquestionably economical but find tendency to flow" (sand and gravel). "Other steel cut out quickly necessitating frequent replacements at heavy expense" (sand and gravel). "Outwears white iron 3 or 4 times but will not stand shock" (cement).

TILE MACHINE (cement products)—"Lasts longer than any other metal; pays to use best wearing parts money can buy."

TRACK FROGS (railway—3 users)—"Wears longer and saves time and delays" (sand and gravel). "Always give longer service" (cement).

TRACTOR TREADS—"Give longer wear, are economical."

TROLLEYS (Carrying rotary calcining furnace in alkali works)—"Never found any metal equal to manganese steel."

TUBE-MILL DISCHARGE PANS—"Last a great deal longer" (cement).

TUBE MILL LINERS—"Last 100% longer than ordinary cast steel" (cement). "Tendency to flow a disadvantage, nevertheless justified because of uninterrupted production."

TUBE MILL SCREENS—"Tendency to flow closes screen openings, nevertheless use is justified" (cement). "Warping makes removal necessary before wearing out" (cement).

Summary

We have given the experiences as they came. We have omitted none of the unfavorable comments. Of course the very best proof of the economy of manganese steel is its very widespread use. It is, from an analysis of the above tabulation, more economical in some places than in others.

Fuller-Kinyon Conveying System

By Alonzo P. Kinyon
Inventor of the System

THE invention of the Fuller-Kinyon conveying system was suggested by observing a condition in connection with handling pulverized coal which was the source of trouble, annoyance, and even danger in the industries employing pulverized coal as a fuel.

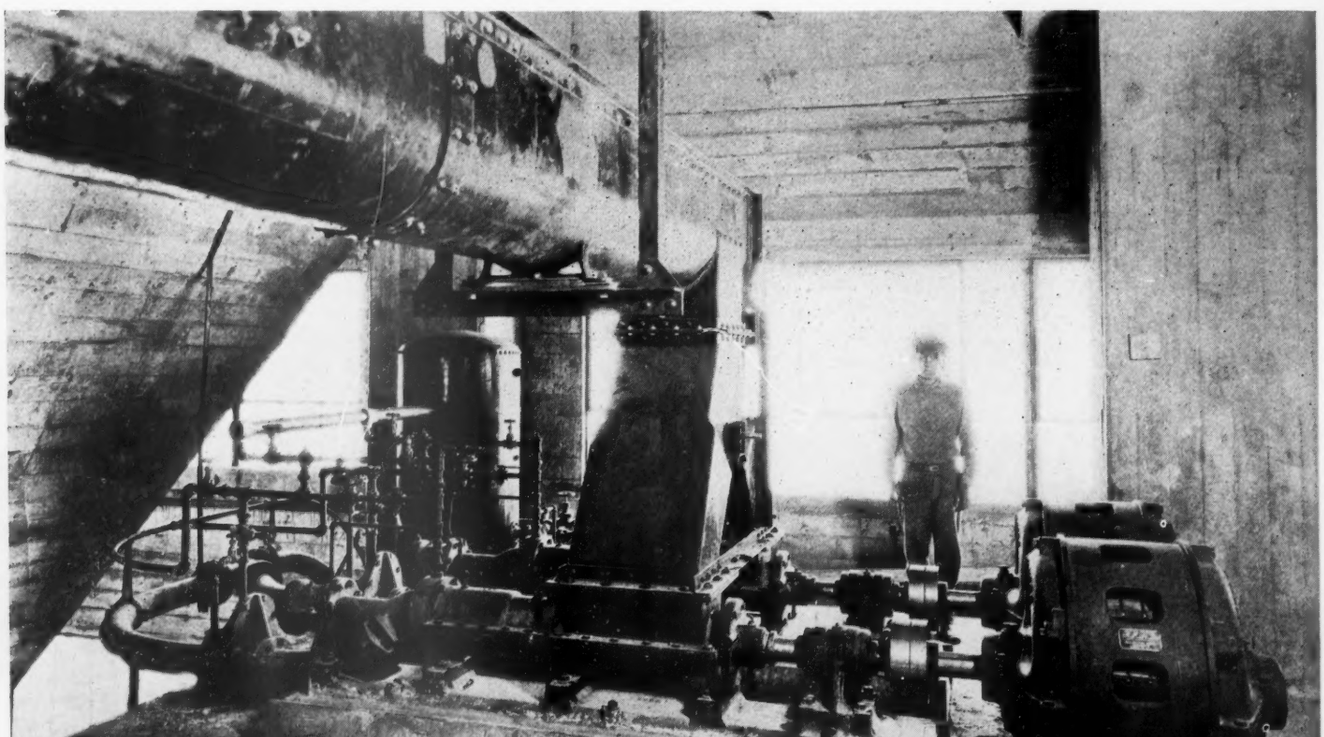
The industries using pulverized coal at the time of the invention of the Fuller-Kinyon system, late in 1918, were practically confined to the metallurgical and cement manufacturing fields. Today pulverized coal is used extensively in large public service power plants, as well as in many industries plants, as the most economical and efficient means of burning coal under large steam generating units.

The peculiar and dangerous condition above referred to was known, in the metallurgical and cement industries, as the flooding or flushing of pulverized coal in screw conveyors. It frequently occurred where pulverized coal was being moved from storage tanks or bins to burners by means of screw conveyors, that at times coal would start to flood or flow in the conveyor trough just like water, and although the screw would be stopped in an effort to stop the flooding, the material would continue to flow around the screw flights very much as water would flow until the conditions that were causing it had spent themselves.

This flooding resulted in the delivery of a large amount of coal above that required, and in some cases caused explosions in the furnaces or cement kilns which caused no little damage. It also was a source of personal danger to the operatives.

The inventor of the Fuller-Kinyon system, who had spent many years, in fact his entire active business life, in the mechanical department of railroads, being particularly interested in fuel economy, entered the pulverized coal field in 1916 and learned first of the flooding action of pulverized coal from those who had been in the business many years. Later he learned much of this condition by actual observation and experience. He, fortunately, not fully realizing the trouble and danger possible from the phenomenon, viewed the flooding from an altogether different standpoint than had been the case with those familiar with it. The thought occurred to him that if pulverized coal would flow like water, and it could be discovered what caused it to do so, it might be possible to use this condition for conveying pulverizd coal through pipe lines or conduits the same as any liquid, that is by means of a pump of some sort. It was also realized that the successful conveyance, in this way, of pulverized coal would prevent the escape of dust so prevalent with the conveying and elevating means then in use, screw conveyors and elevator. This dust accumulated on the beams and shelving portions of the building in which it was released and created a constant menace from the possibility of explosion if it was violently disturbed and then ignited.

Studying the matter carefully and questioning those familiar with the flooding of pulverized coal, the inventor concluded that the flooding was due to the presence of air in the material, and that this air became present by its filtering through the coal mass in the bin to spaces above the screw conveyor that were formed by coal feeding out and bridging over the conveyor at different points within the bin. In time by the formation of other spaces the mass of coal was undermined to a point at which the bridge weakened and fell, and the air having no means of egress permeated the falling mass and liquefied it. The momentum of the falling body of coal created pressure which



A pair of Fuller-Kinyon pumps showing the complete installation

imparted velocity to the "liquefied" pulverized coal, and under this pressure it escaped through the only opening possible (the screw conveyor) thus causing the phenomenon known as flooding, the flooding continuing until all of the material that had been aerated was forced out of the bin.

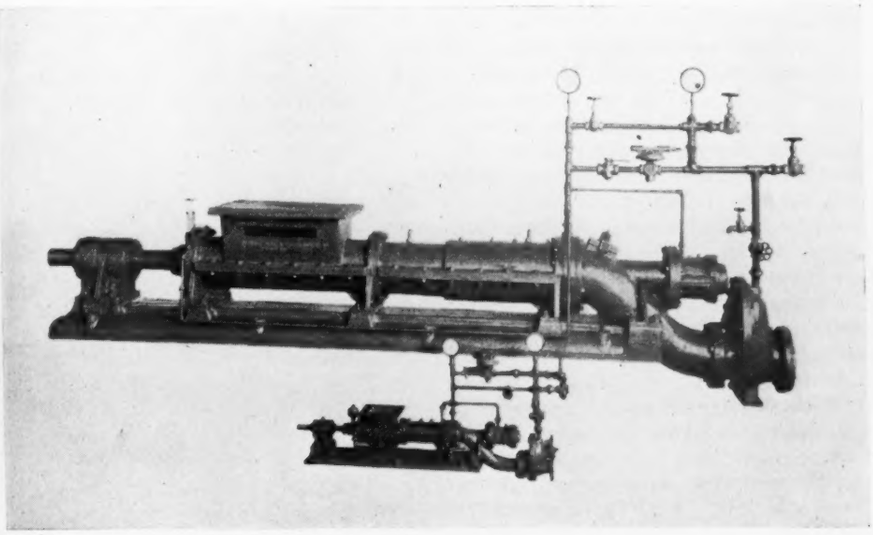
With this hypothesis before him the inventor concluded that all that was necessary to pump pulverized coal was to provide means for injecting air into the coal mass and then apply mechanical force to move the liquefied material through pipe lines. An investigation of the different types of pumps in use showed conclusively that a new type of pump, in which were combined means for aerating as well as applying force to the aerated material, would have to be designed.

This work proved comparatively easy considering that it was an absolutely new art with no data of any sort; only the vague ideas and the deductions which had been made from observations of the flooding of pulverized coal.

It took about eight weeks to build and operate the first pump which was, compared with the present machine, a crude piece of mechanism. But with it pulverized coal was pumped a distance of 52 ft., with a lift of 4 ft., at the rate of 20 lb. per minute. Not far, not much of a lift, and not by any means a large quantity, but the experiment proved that the premises upon which it was worked out was correct, and it remained only to develop the machine to produce larger capacity and carry the coal to longer distances and greater heights. Development work continued for several months to a point where pulverized coal was pumped a distance of 200 to 300 ft., and to an elevation of 25 ft., at a capacity of 4 or 5 tons per hour, with a 3-in. line. These latter results were obtained during the summer of 1919, and during that time the first real model of the Fuller-Kinyon pump was designed.

The need of certain auxiliaries in the way of valves, material level indicating devices for the storage bins, and automatic operation of the equipment was early realized, and these and many additional devices have been designed as the need for them has arisen from time to time.

Many uses other than that of pumping pulverized coal have been found or developed for the Fuller-Kinyon conveying system. Among the other materials handled at this time are to be found finished cement, ground limestone, flue dust, soda ash, starch, mixtures of pulverized material such as magnesite dust and pulverized coke, paint pigments, dust from dust-collecting systems, pulverized silica, and many other finely divided materials.



The Fuller-Kinyon pump as used for pumping pulverized coal, cement and other finely divided materials

The theory of the Fuller-Kinyon system is that of filling the interstices between the particles of pulverized material with air, the air acting as a buffer or filler to separate the particles one from another and thus prevent the material from packing. This introduction of air to the interstices actually produces a fluid condition of material and it really flows like water. It has been found in handling the heavier materials, particularly cement, that a certain velocity of the aerated material must be maintained in the pipe line to insure continued intimate aeration. It has also been discovered that there is little or no wear of the interior of the pipe lines or conduits through which the material is pumped. This is believed to be due to the fact that above certain velocities the air and cement or other material is agitated and really becomes a liquid mass in which the heavy particles are rolling over and over on the lighter particles of air. The air in a measure acting as ball bearings for the heavier particles, with the result that there is a rolling friction within the pipe line instead of a sliding friction. In this way only can one account for the very slight wear of the interior of pipe lines through which cement and other abrasive materials are handled by the Fuller-Kinyon system.

In connection with the original pump, valves, bin signals, electro-pneumatic units and electric operating boards have been developed to a point where today the Fuller-Kinyon system is accepted in those branches of the trade where it is known as standard equipment. This is particularly so as a means for conveying finished cement, as well as cement from storage to pack house, and for conveying pulverized coal, not only in cement plants, but in the large super-power plants being erected all over the world at the present time.

During 1925 there have been many noteworthy installations of the Fuller-Kinyon system, one of particular interest in connection with the handling of pulverized coal being that at the Columbia Power Station of the Columbia Power Co., where a number of Fuller-Kinyon pumps are in operation conveying pulverized coal distances of several hundred feet with a 100-ft. elevation, and at capacities up to 60 or 80 tons per hour per pump.

A notable installation of the Fuller-Kinyon system has been made the past year at the plant of the Standard Portland Cement Co. at Painesville, Ohio, where Fuller-Kinyon pumps are supplying coal through 2800 ft. of 5-in. line to the kilns, pumping cement from the finishing mills to the silos, and from the silos to the packers, and also handling flue dust.

Igneous Rock Formation

THE PHYSICAL CHEMISTRY OF IGNEOUS ROCK FORMATION. A general discussion. Faraday Society, 90 Russell street, W. C. 1, London, England. October, 1924. 87 pages. Price 6s. 6d. net.

THIS book is a compilation of many short papers read at the October joint meeting of the Faraday Society, the Geological Society and the Mineralogical Society. These papers were presented by many prominent English scientists and were followed by interesting discussions from the members present. Some brought out the work done on this subject from many angles and others dwelt on the proposed further research and the ultimate problems yet to be solved. In fact, great emphasis was placed on the need for this further research. A study of the papers presented shows that the physico-chemical history of igneous rock is still a matter of conjecture.

Although many phases of the physical chemistry of magmas are untouched, the book is excellent for geologists and others interested in rock formations, for it covers a wide field.

Developments in Machinery and Equipment

All Branches Show Improvements and Gains in Strength and Efficiency

MACHINERY developments in 1925 were not radical, but they were noteworthy in that they showed a tendency to build stronger and more efficient units. This is especially marked in the excavating and machinery handling field. Neither electric shovels nor Diesel shovels are new, but in 1925 their range was greatly extended. Diesel power is now applied to small units as well as large and with the fullest success.

The application of electricity to power shovels has proceeded so far that now (according to the figures of the General Electric Co.) over 40% of all shovels made are electrically powered. Caterpillar, or crawler, treads have wonderfully increased in use, one manufacturer reporting that 95% of his orders call for this mounting. Even the largest sizes are now mounted on crawler treads.

In power plant and transmission equipment one notes a similar advance along the lines marked out in 1924. Waste heat boilers have been installed in half the cement plants built. The Diesel-electric drive is going into even the smaller plants. The synchronous motor is being used more and more in order to increase the load factor. Speed reducers have grown in popularity so that in the newer plants there are almost no belt or open gear drives, belts being used only where they are necessary for safety.

Conveyors have been installed in longer units and the use of the self-lubricating idler with ball or roller bearings is now almost universal on installations in the rock products industries.

Crushing machinery has shown no radical novelties, but in separating devices a number of new and improved machines have appeared. These apply particularly to the machines to work on the finer mesh sizes.

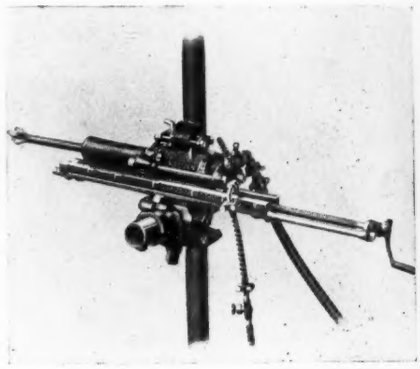
Drilling and Blasting

NOTABLE improvements in the design of well drills have not been reported to any extent this year. The Armstrong Manufacturing Co. notes that it has added a specially designed counterbalance on the spudding beam of its No. 50 drill which has increased the capacity without adding to the size of either the power plant or the drilling mechanism. The machine, according to the makers, will now handle a 5-in x 20-ft. (or 22-ft.) stem with 8-in. 400-lb. bits at 55 to 60 strokes per minute. This company notes the tendency toward larger diameter holes and heavier equipment and it has designed this drill accordingly.

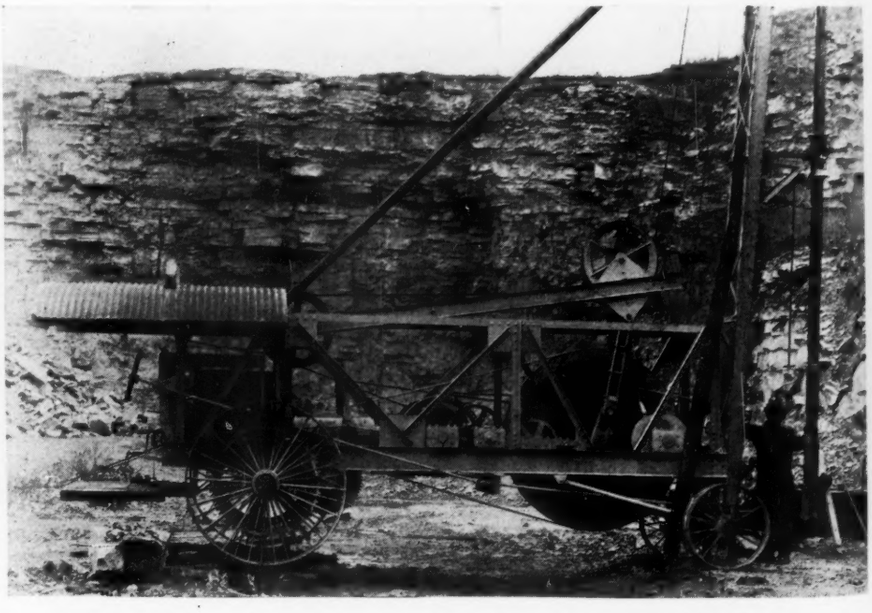
In the smaller drills (tripods and jackhammers) several new models have made their appearance. The Sullivan Machinery Co. has a new model (D64) of piston drill using the 3-spool independent valve, which has been successful on this company's rotator drills. The D64 has combined water and air jets, with separate control, for cleaning holes and laying dust and a number of other features which add to its efficiency.

The Denver Rock Drill Manufacturing Co.'s Waugh Turbro hammer drill on derrick mounting, which was described in an earlier issue this year, is reported to have passed the trial stage and to be growing in popularity for quarry work where benches are not over 30 ft. high. On a 20-ft. bench only three changes of steel are necessary, which makes a footage of 200 to 300 ft. per day for each drill, depending on the formation, possible.

Another mounted drill for deep holes is the wagon drill recently brought out by the Ingersoll-Rand Co. It is the X-70 drill of this company's make mounted on an all-steel wagon which carries uprights so that long steel may be changed easily. Either a hand winch or a "Little Tugger" air hoist can be used for raising the drill. For wet operation a water tank is suspended under the framework of the wagon and the water in the tank is put under air pressure for feeding to the drill. Very large footages



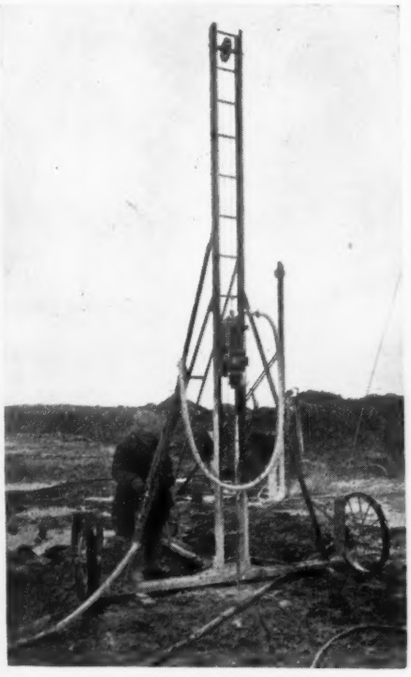
Piston drill with 3-spool independent valve



Drill with specially designed counterbalance on the spudding beam which increases its capacity

have been reported from the work of this drill in limestone and rock asphalt.

The same company has brought out a line of long-stroke, four-cylinder pneumatic drills which it claims are unique in being equipped



Hammer drill on derrick. Only three changes of steel needed in 20-ft. holes

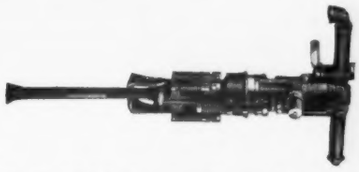
with speed governors that prevent "racing." This saves air and also wear and tear on drill parts.

The Cleveland Rock Drill Co. has a new hammer drill (Model 44 SDRA) for which it claims remarkable records in broken and fissured ground. The machine is fitted with an extra powerful blast for cleaning the hole, and is reported to have drilled successfully in mixtures of tough clay with hard "nigger heads" that had to be drilled through as the drill came to them. The blast cleaned the hole so well that the steel could be withdrawn and changed without difficulty.

In compressors the Sullivan Machinery Company notes a new portable air compressor of 220-f.t capacity.

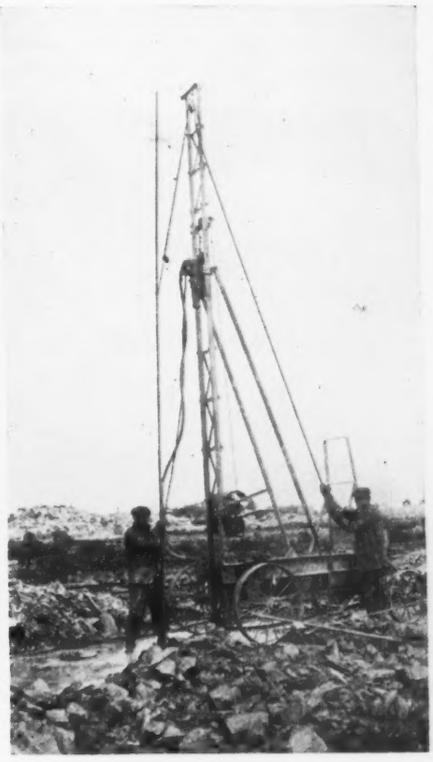
In explosives, the du Pont company notes as the principal advance of the year the increased use of gelatin. Concerning this the company writes ROCK PRODUCTS:

"The density of this explosive permits the concentration of a heavy charge at the point where the greatest explosive force is needed to pull the bottom clean and its cohesiveness makes it safer to load, especially in the deep well drill holes with which a great number of large blasts is now shot. Quarry gelatin, which was introduced by the du Pont company in 1924, has reduced blasting costs in a good many quarries because it has about 10% greater shattering power, grade for grade, than the regular gelatins. In some quarries economy has been achieved by replacing the dynamite formerly used with a lower strength quarry gelatin; in others by substituting quarry gelatin of the same strength as previously employed and securing better fragmentation."



Drill which has made good records in broken ground

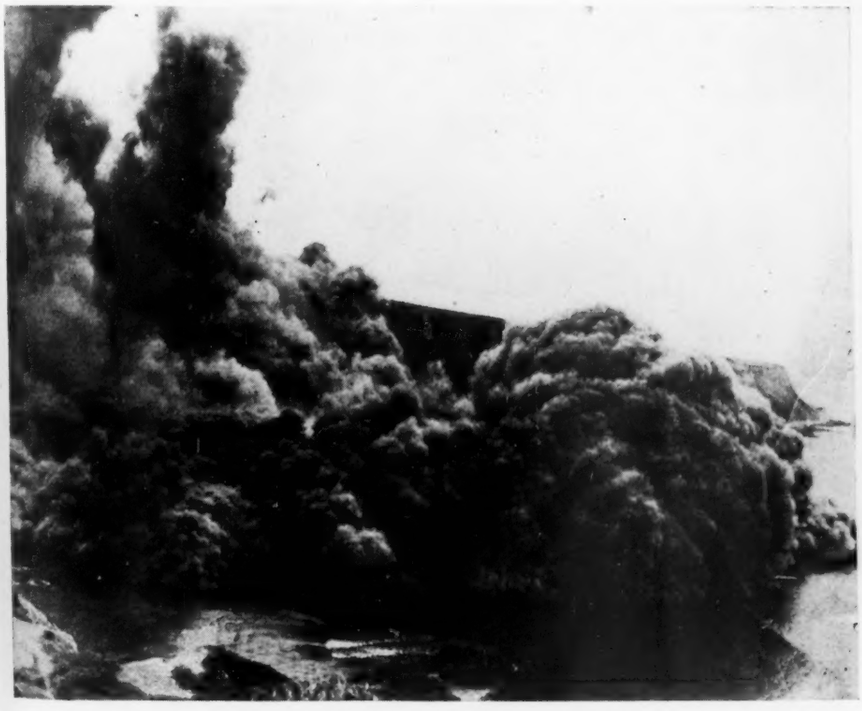
The Hercules Powder Co. has developed a new powder, Hercules No. 3, especially adapted to underground work where fumes are important. It has also further developed "Hercoblasting," the method in which specially grained black powder is column loaded and then detonated throughout its entire length with Cordeau-Bickford detonating fuse. Dynamite may be used in the bottom where the rock is hard. A typical



Wagon mounted drill fitted with hoist to raise and change steel

"Hercoblast" is described by the company as follows:

"The work of a Hercoblast at the Western Lime and Cement Company's quarry at High Cliff, Wisconsin, recently proved to be equal to that of any dynamite blast ever fired in the quarry. Sixteen well-drill holes 6 in. in diameter and 23 ft. deep were loaded with 1,625 lb. of Hercoblasting powder and 225 lb. of dynamite. The holes were 14 ft. apart, 18 ft. from the toe and 15 ft. from the rim of the quarry face. The height of the bank was uniformly 22 feet, with a burden of 12 ft. on the rim and 18 ft. on the toe. A typical hole carried a charge of 75 to 100 lb. of Hercoblasting powder and 12½ lb. of dynamite. A fuse and cap fired the blast. This quarry was always regarded as a difficult blasting problem because of the presence of a number of seams running diagonally to the face, which allowed the explosive gases to escape. Regardless of this, the Hercoblast broke down 2300 solid cubic yards or 5175 tons of limestone."



Blast in a Wisconsin quarry. It was loaded with black powder and dynamite and specially detonated

Excavating and Material Handling

THE progress of excavating and material handling machinery has been very marked in some lines, as shovels, draglines and cranes, and not important in others, as in dredging pumps for example. In shovels and draglines we may note three improvements, the use of the crawler tread on the larger sizes of machines, the use of Diesel power and improvements in the application of electric power.

Some of this progress is exemplified in the 4-yd. full revolving shovel, introduced by the Bucyrus Co., No. 120 B. This is said to combine the speed and power of the railroad type with the advantages of the crawler tread. The machine has the long reach and full circle of the "whirley." It weighs 140 tons and is built for either steam or electricity. The same company has applied the caterpillar tread to one of the largest excavators built, a Class 320 dragline, which weighs 400 tons and handles an 8-yd. bucket.

A new full revolving shovel designed to have the strength and speed of the railroad type combined with the advantages of the crawler tread

The Ward-Leonard control is applied to the thrust motion on the electric shovels of Bucyrus make and the company says that it believes this use of the Ward-Leonard control is new.

What is probably the first large dipper dredge to use Diesel power was built by this company in 1925. It is said to be the largest and most rugged dipper dredge ever constructed and it requires 1200 h.p. to operate.

The Marion Steam Shovel Co. has brought out the new Model 125 which was described in the issue of July 11. It handles a 4-yd. dipper with a 35-ft. boom or a 3-yd. dipper with a 45-ft. boom and is mounted on crawler treads.

The construction of this machine is said by the makers to set a new standard from the increased use of alloy steel and the heavy frames.

The Northwest Engineering Co., which has been one of the leading manufacturers of gas-driven shovels, cranes and draglines has been developing a full-Diesel power plant for its machines, during five years of study and experimentation, and has brought out the Northwest-Cummins Diesel engine, a 4-cylinder motor, which it is applying to shovels, cranes and draglines from ¾ to 1½-yd. capacity. This is a true Diesel and not a semi-Diesel engine, running at 500 lb. pressure. It starts without torch or hot spot or other heating device.

The makers claim that some of their machines, equipped with this new engine are being operated with a fuel cost as low as 90 cents per day.

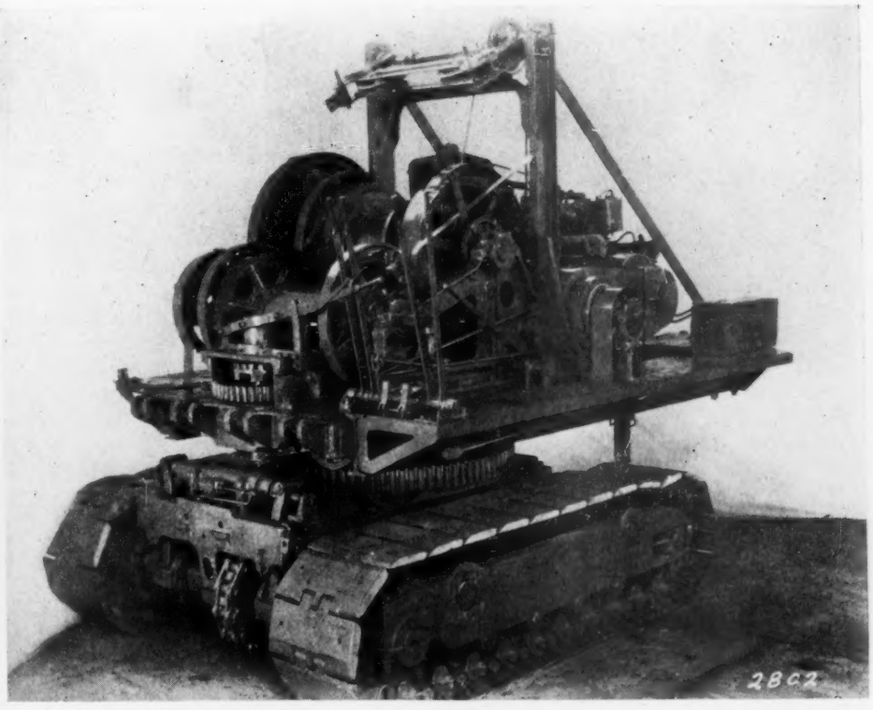
New shovel with four-cylinder full Diesel motor

The Osgood Co. introduced a new power shovel in 1925 which has all the operating machinery, including the motor, mounted very compactly on the unit cast-steel center member so that everything is in accurate and permanent alignment. As with all the other new machines this shovel is mounted on crawler tread. It has also unusual convertible features in that the work required to change the shovel to a dragline, crane or special derrick machine is very small.

From England comes a notice of the new Ruston and Hornsby No. 5 convertible which can be had with rail, traction wheel or caterpillar mounting. The makers report that 95% of their orders are for the caterpillar tread. This machine has been especially designed as an "all around" machine

Power shovel which handles a 4-yd. dipper on a 35-ft. boom and yet is mounted on crawler tread

which may be put to almost any job. As a shovel it carries a 20-ft. boom with a ⅞-yd. dipper, as a dragline it handles a 30-ft. boom with a ¾-yd. bucket and as a crane it will handle a 30-ft. boom and ¾-yd. clamshell. It is fitted with either steam or electric drive. The very large draglines made by this company were described in the October 31 issue.



The machinery of a new "convertible" which is compactly mounted (with the motor) on a unit cast steel center member

Link-Belt has brought out its all-purpose crawler with a new boom and dipper stick to be used with it when it is converted to a shovel. It is shown on page 173. The new boom and stick are designed to prevent the breakdowns and expensive maintenance which are ordinarily a source of annoyance from these parts. Some forty machines have been put in operation in sand pits and quarries and a survey made of these machines showed that these parts were giving excellent attention with negligible service.

An Orton and Steinbrenner 1-yd. shovel, fitted with a Climax Model T engine, made a remarkable record this year when it climbed a mountain near Wilkes-Barre, Pa., to strip a coal seam 3000 ft. up the side. It is stated that at one place a 40% grade was surmounted, but the shovel made the trip and arrived ready to go to work and apparently none the worse for the experience.

The Industrial Works (Bay City) has a new combination machine (Industrial Type D. C.). This is a 12½-ton tractor crane that may be readily converted to a ⅞-yd. power shovel or a 1-yd. dragline. It is built for either steam, electric, gasoline or Diesel power and is mounted on crawler treads. Where gasoline is used for power it is fitted with a Climax engine and for fuel oil it is fitted with either Bessemer, Atlas or Fairbanks-Morse Diesel engines.

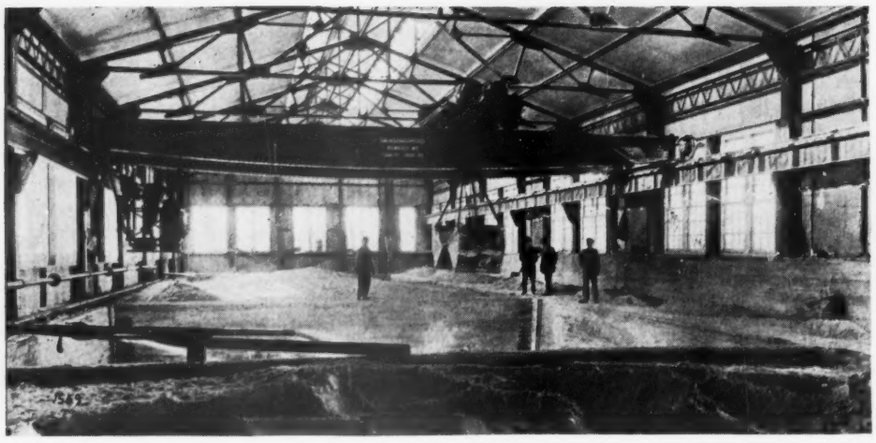
The Harnischfeger Corp. have brought out two new models of their P. & H. convertible. The Model 204 has already been described in Rock Products. The Model 207 is a 1-yd. shovel convertible to a 1-yd. clamshell, crane or dragline with a 40-ft. boom. It is powered with a 76-h.p. motor which may be either a steam, gas or Diesel engine or an electric motor. This company has made a number of important installations of travelling cranes in connection with rock products industries for the use of travelling cranes for handling in and out of storage and like work is becoming more general each year. The installation shown here is in the dry house of a silica sand plant where it is used to handle sand from the wet storage to the dryers.

A 1-yd. steam shovel that climbed a 40% grade on its crawler treads

Among the smaller sized machines which are so useful about the plant for stockpiling, truck loading and the like may be mentioned the Mead-Morrison "half-yard crawler" built for a wide range of work combined with light weight and speed. It is of the live-boom type and requires only a single re-reeving to change from one kind of work to another. It may be used either as a shovel, clamshell crane or dragline. It has a hoisting speed of 150 ft. a minute, swings four times a minute and travels at 1 mile per hour. The power plant is either a Hercules heavy duty 4-cylinder gas engine or a 30-h.p. electric motor.

Coming to wagon or truck loaders, the Barber Greene Co.'s new Model 42 is finding a considerable use for handling crushed rock and sand and gravel from outside storage. One advantage of having such storage apart from plant bins is that of having two points at which truck loading may be carried on during rush hours. This loader, it is stated, has loaded 7 tons of ¾-in. crushed stone in 3 minutes, and it can travel along the piles to points where it is needed under its own power.

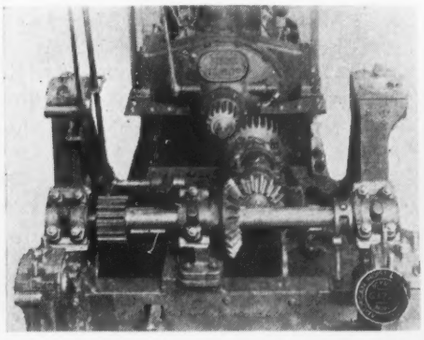
Among the developments in hoisting machinery may be mentioned the new two-speed hoist of the S. Flory Manufacturing Co. This has an improved band friction which allows the speed of the drum to be changed while the motor is running, which avoids the use of complicated control mechanisms. It is driven by either electric motor



A large traveling crane installation in the dry house of the Ottawa Silica Co., Ottawa, Ill.

or internal combustion engine. This company recently installed a large electric hoist at the plant of the Edison Cement Co., New Village, N. J., which pulls a 7½-ton car up a 35% grade.

The American Hoist and Derrick Co. has redesigned its gasoline-driven hoist and

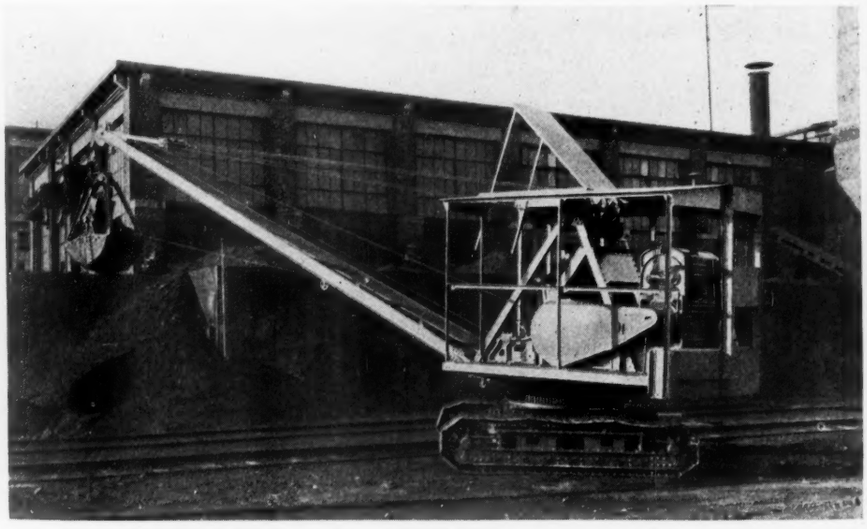


A new geared hoist, shown with the protecting cover removed

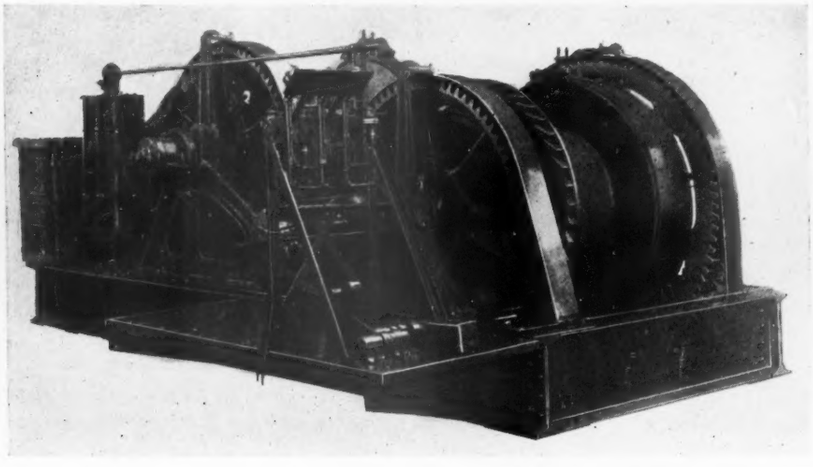
has changed to a gear drive. The main advantage claimed for this is that the power is transmitted directly to the pinion shaft by at least two teeth in mesh whereas by the old arrangement the power was transmitted by only one tooth. The picture which shows this drive was made with the gear covering removed. In operation all gears are fully guarded. This company announces that its perfected combination shovel, dragline and utility crane, on crawler treads, will shortly be placed on the market.

Clyde Iron Works reports an unusual installation of its hoisting engines in the pit of the Illinois Valley Silica Co. of Ottawa, Ill. One hoist operates a Page bucket on a 40-ft. boom which does the stripping and another runs a scraper bucket that digs the sand. The strippings are hauled away in cars and dumped into an abandoned pit by a third hoist. The unusual feature of this operation is that all these hoists (and a fourth) are driven by steam supplied from a central plant which also supplies steam for other parts of the operation.

Sauerman Bros. have introduced very large sizes of cableway draglines and scraper buckets in 1925. Notice of one of these cableway buckets which handles 3½ cu. yd. is to be found in the review of the sand and gravel industry. Naturally these very large machines require a hoist especially built for the work, and Sauerman Bros. have designed and built such a hoist which is giving excellent service. The cut shows the



A "half-yard" crawler convertible which is of the live boom type and requires only a single re-reeving of the rope to adapt it to different kinds of work



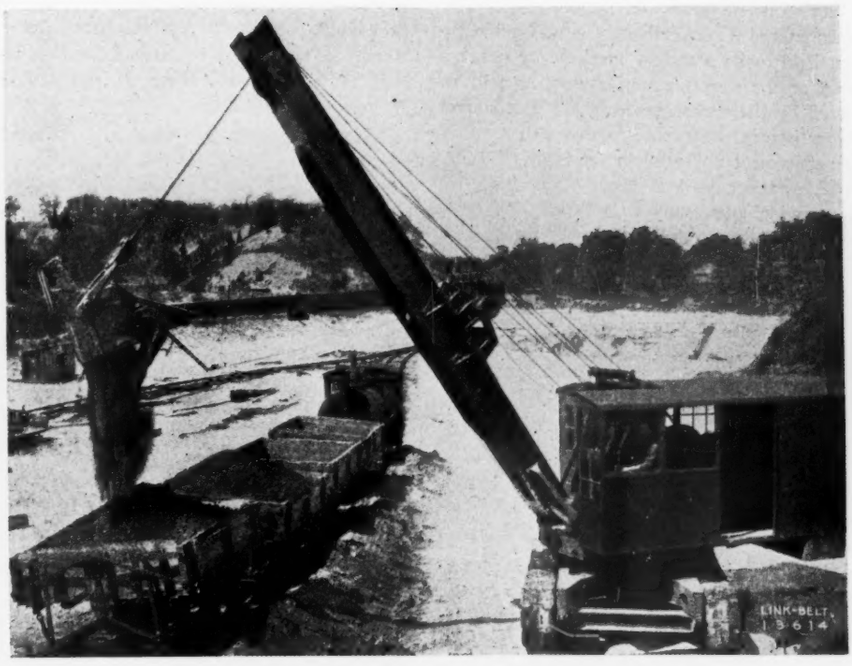
New hoist for handling heavy cableway dragline and scraper buckets

compactness and the rugged construction of this machine.

In the way of buckets and dippers there seems to be little that has not already been mentioned in the "New Machinery" of Rock Products.

The Blaw-Knox Co. brought out the "Dreadnaught" bucket, for rapid handling of material from stockpiles (November 28) with the unusual system of lubrication. This company is specializing on batcher bins and truck loading bins, an important development in the aggregate industry, several examples of which were described in various issues of this paper.

The Clark bridge dipper, introduced by the American Manganese Steel Co. (described in the June 13 issue) should be mentioned among the important developments in shovel dippers.



A new all purpose crawler used as a shovel, with a specially designed boom and stick, designed to prevent trouble from breakages of these parts

The Hayward Co. has introduced a new idea in the use of buckets by adapting the bowl or shell of the bucket to be used as a measuring device for sand and gravel in mixing concrete for street paving.

Pumps for dredging seem to have made no special advance during the year. The Morris Machine Works reports that it has made special pumps for handling slurry in cement plants that reduce the water needed to protect the packing to a negligible amount. These were described in the story of the Peerless cement plant.

It is understood that a new dredging pump of unusual design is to be placed on the market in the coming year by Fairbanks-Morse & Co., but the makers say they wish to withhold announcement for the present.

Quarry Transportation in Retrospect

By W. E. Farrell
Chairman, Manufacturers' Division, National Crushed Stone Association

A QUARTER of a century is a short time commercially, industrially or even in the life of man. Yet 25 years ago there was practically speaking little or no crushed-stone industry. Ballast was the chief, if not the only, product of plants producing crushed stone previous to 1900.

So insignificant was the entire field for rock products that a journal starting the early part of this century entitled Rock Products and published monthly could find only about two pages each for such subjects as "Cement," "Lime," "Salt," "Plaster," "Gravel," "Marble," "Quarries" (cut stone), "Asphalt," "Monuments," "Artificial Stone," and "Slate."

Crushed Stone Hardly Mentioned

The subject of "Crushed Stone" was of so little importance in the beginning that under "Quarries" the subject was treated chiefly almost solely as applying to cut-stone quarries. The home of Rock Products at that time was Louisville, Ky., the subscription price $1 a year. It carried few or no illustrations. There were four advertisers of crushers, one of cars and no advertisements of shovels or locomotives.

The first ten years of this century were very momentous ones in the crushed-stone industry, an industry of huge proportions today. So huge it is hard to realize its birth is almost contemporaneous with the St. Louis World's Fair, the San Francisco fire, and the building of the Panama Canal. In those ten years the output of crushed stone was more than quadrupled. A review of these years in the crushed-stone industry, as pictured by the pages of Rock Products is both interesting and instructive.

First Power Shovel Installation Not Considered a Success

In a descriptive article appearing in the last part of 1904 a change of management is said to have brought about the introduction of a steam shovel into a certain quarry; but that it proved so unsatisfactory that the article stated: "There is no machinery in the quarry today, except drills."

In the beginning of 1905 the car manufacturers' advertising has grown to four concerns, yet the cars shown in these advertisements are light and small, 1- or 2-yd. affairs. However, one manufacturer showing a wooden body car, really a coal mine car, has in flamboyant type "Something Entirely New in Quarry Cars."

The October, 1905, issue had an article on "A Modern Rock Crushing Plant" wherein the author speaks of the use of locomotives but does not mention shovels.

It is significant to note in this connection that in the following month, November, 1905, there appears for the first time an advertisement of a locomotive, that of the Davenport Locomotive Co., and it is many years before a competitor appears in the advertising pages of this paper. For which there is a very significant reason as will appear later.

As reported in the December, 1905, issue the General Crushed Stone Co. at Leroy were then producing 3000 tons per day of stone and may have been using a shovel, through the descriptive article does not mention it.

Crushed-Stone Handling Costs and Prices 20 Years Ago

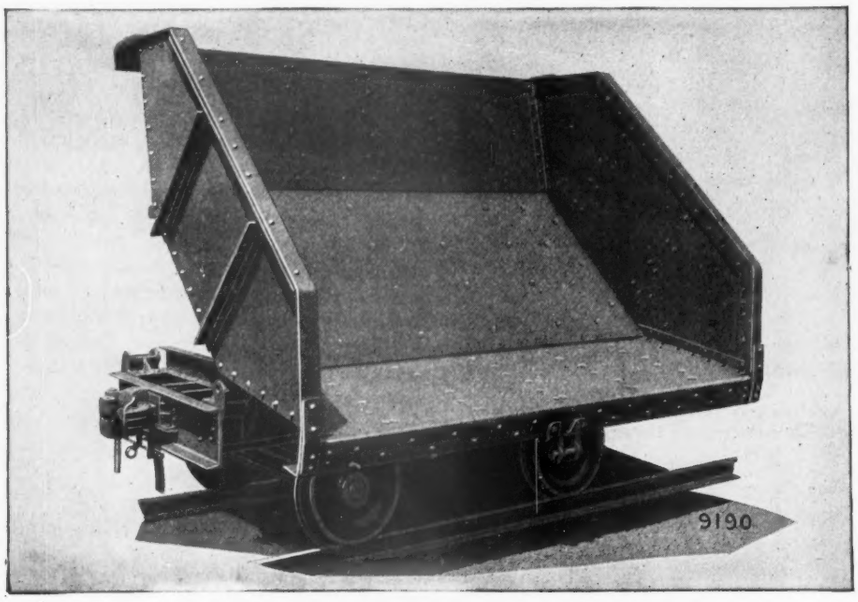
It was contemplated that at the February, 1906, meeting of the Quarry Owners' Association it would be well to discuss the formation of a crushed stone association but this appears to have been deferred. However at this February meeting there was some discussion of a new method of handling stone to the crusher with a shovel which ran on a track and had proven economical; there was some adverse opinion as the costs; in some quarries it was 10 cents a yard with a mule and car, while others reported 13 cents with dump cars (presumably hand loaded). At the same time it was suggested that 60 cents for ballast and 70 cents for consumers' stone should be a minimum price.

In the following months appear articles on "The Crushing Business—Influence of Up-to-Date Equipment," and answer to questionnaires; all of which indicate a lack of familiarity with the shovel or its value in a quarry as it is considered at best as "a large item of expense." This might well be, for an advertisement appears towards the end of this year 1905 for 50 quarrymen at $1.54 per day of 10 hours.

In the beginning of 1907, while the number of manufacturers advertising crushers has grown to be 14, the locomotive advertisement is withdrawn, and no shovel manufacturer is appealing to this trade.

A call is again issued for the crushed-stone producers to meet in Chicago March 5 for the purpose of organizing; but no notice of such a meeting being held appears in the next issue. On the contrary there is published a letter from a quarry man (crushed stone) who says: "I am getting old—my machinery is all out of date—and like myself is worn out. I intend to close out my business." Some other quarries possibly closed also, for 1907 was a hard year on quarries and other industries.

The only sign of prosperity was that in that year Rock Products moved to its new home in Chicago, though this did not seem to affect the size and appearance of the paper, which occurred some years later.



This new quarry car is planned and built to resist the heaviest loading shocks, and is of the doorless type

Rock Products Leads the Way

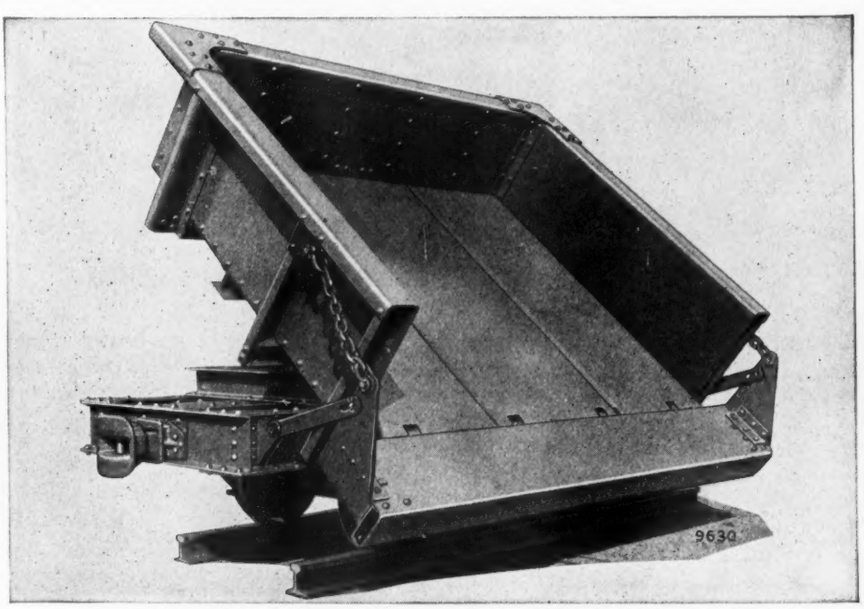
In June, 1907, Rock Products made a plea for the need of larger crushers to handle larger stone, which was sure to come with the introduction of the shovel in the quarry —evidently like all up-to-date trade journals having a vision into the future beyond that of most of its subscribers.

In describing a great crushing plant at Toledo no small credit is given to the shovel for its value—all stripping operations and in the construction of the railroad tracks and sidings where execavation is an important item, the use of the shovel seems to have ended here, since in neither of two views of the quarry is this "Little David" shovel to be seen.

All this time the shovel was recognized as a valuable asset in cement-mill quarries, for handling or digging shale. It had long ago become absolutely necessary to the excavating contractor and railroad builder and had by these two last been employed in handling stone of small and large sizes as they encountered it; nevertheless, it was evidently not held to be a quarry machine by quarrymen or the shovel manufacturer, as will be noted by the claims made in the first shovel advertisement appearing in this paper. This advertisement appeared in the issue of June, 1907, and occupied a space ½-in. high by 3 in. wide and reads as follows: "Vulcan steam shovels are *digging* cement rock *without blasting* and loading it for the Burt Cement Co. of Bellevue, Wis., for less than 12 cents a cu. yd., and they are operating the shovels at only one-half capacity."

The italics do not appear in the advertisement, but are mine to emphasize the use, in the opinion of the manufacturer, to which shovels could be advantageously applied to in quarries. "Digging" and without the necessity of blasting.

The quarry field as a market for shovels was so small that while this advertisement, the only one of a shovel, ran for several months, it was never changed in size nor in its wording.



One of the features of this car is that the door is flush with the bottom when the stone begins to move so there is no danger of a hangup

Shovel Manufacturer Uses Demonstrations

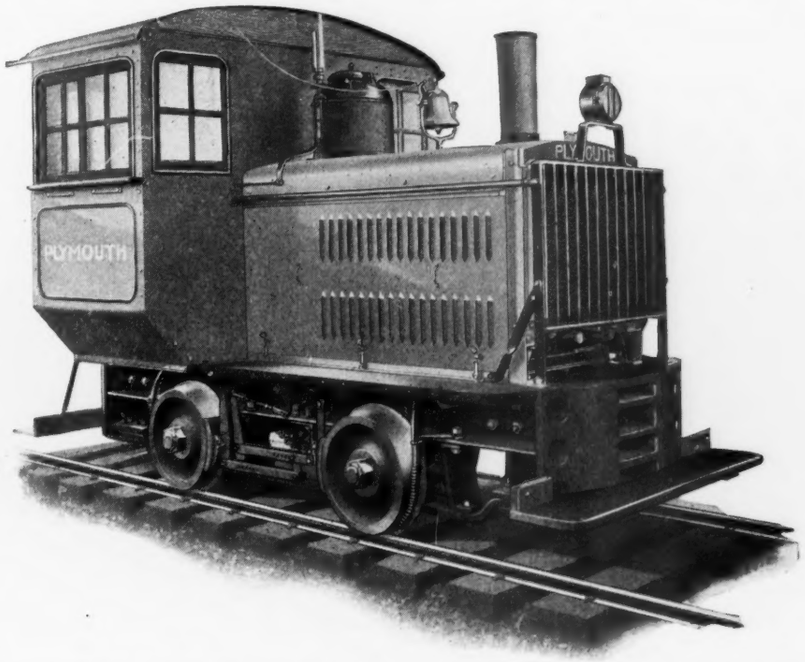
At the annual meeting of the Ohio Stone Club in February, 1908, they heard among other addresses one made by a representative of the Vulcan Iron Works from Toledo, on "Economies in Quarry Practice with the Vulcan Steam Shovel," and some of the quarrymen became interested enough to accept an invitation to go by trolley car to the Vulcan plant the next day where a practical demonstration was made.

The Bucyrus Shovel Co., not to be outdone, purchased a half page in the next issue of Rock Products to show their 95 shovel handling cement rock, and the claim is made that the Bucyrus should be purchased "For *stripping* quarries or *digging* shale and *cement* rock."

These claims are later modified and the size of the advertisement reduced to one-quarter page wherein they say: "We build shovels for quarry *stripping*, cement *mining* or loading *crushed* rock."

In June, 1908, the Vulcan Iron Works admit in their advertisement that one of their shovels is "Loading *blasted* rock for 2 cents a yard—that's what the Ryan Stone Co. of North Baltimore, Ohio, is doing with a 'Little Giant'."

At this time the operators of the plant of the United States Crushed Stone Co. at McCombs, Ill., were finding their No. 8 crusher entirely too small for their 100-ton Atlantic and Bucyrus shovels, and although the plant had been in operation only a year they decided to purchase and did purchase Edison rolls, which were put in place the next year.



A new 12-ton gasoline locomotive well adapted for gravel pit and quarry work

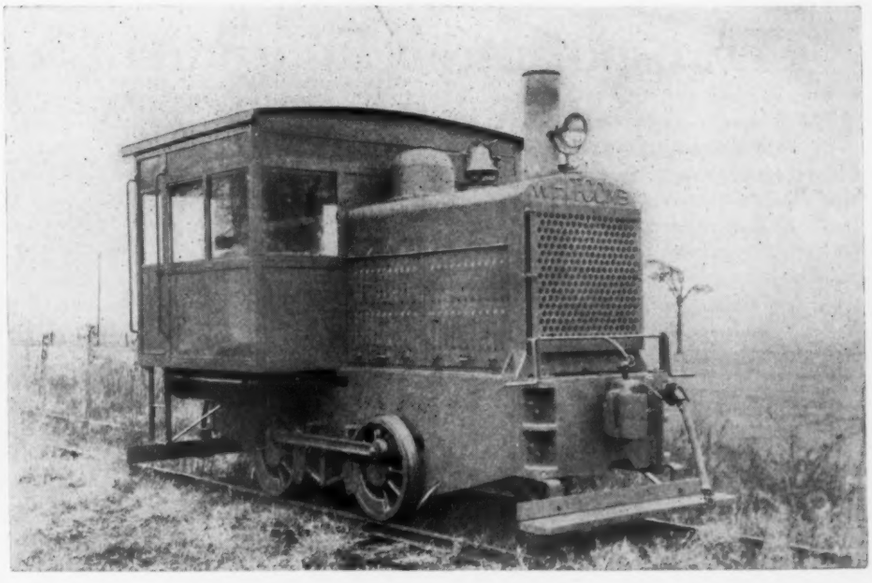
So in February, 1909, speaking editorially, Rock Products says that the "quarries which have adopted the shovel are effecting great economies and it has come to stay. That, crushers in the main have grown in size until the largest today is a No. 18."

Shovels Sold Under Guarantee

And finally in the last month of 1909 that even the most skeptical quarrymen may be convinced bfore investing their hard-earned money in a shovel the Vulcan Iron Works advertise that no prospect need not purchase until he has seen the shovel he intends buying in actual operation loading stone at their own plant, where they have all facilities for a demonstration; and that even then they will ship the shovel, "On a ten-days' trial order under a guarantee."

So Rock Products reaches the year 1910, and begins it with 26 advertisements of crushers against only four in 1904, eight of cars instead of one; two of shovels and one of a locomotive where it had neither beginning the year 1904.

Little or no mention has been made so far of cars in this review other than to refer to the number of advertisements. In fact little else could be said. A great deal is heard about supply and demand, the one creating the other. The demand for what does not exist is of little consequence. The manufacturer has always more faith in his product (the supply) than the user who creates the demand. Note how slowly, and finally under what guarantees, the shovel manufacturer had to move and offer to get the shovel accepted, now the most economical means to handle blasted rock.



A new 22-ton gasoline locomtive, perhaps the largest that has been built for use in the rock products field

No Demand—No Supply—Quarry Cars

During all these years under review and in fact for as many more there was little or no demand for a better quarry car than existed in the days of hand loading because there was no supply.

In fact until only a few years ago there were no shovel-loaded cars offered the quarry other than the shovels' old friend of excavation and stripping days, the wooden body and sometimes also wooden frame hand-dump-to-either-side, contractors' type car. They both, the shovel and the contractors' car, we might well say, go together hand-in-hand from where they were doing the stripping down the quarry floor for stone loading.

The shovel has been strengthened here and improved there, it has been taken off the rails put on caterpillars, "gasolined" and "electrified" and made a truly wonderful machine with strength of an elephant and mind of man!

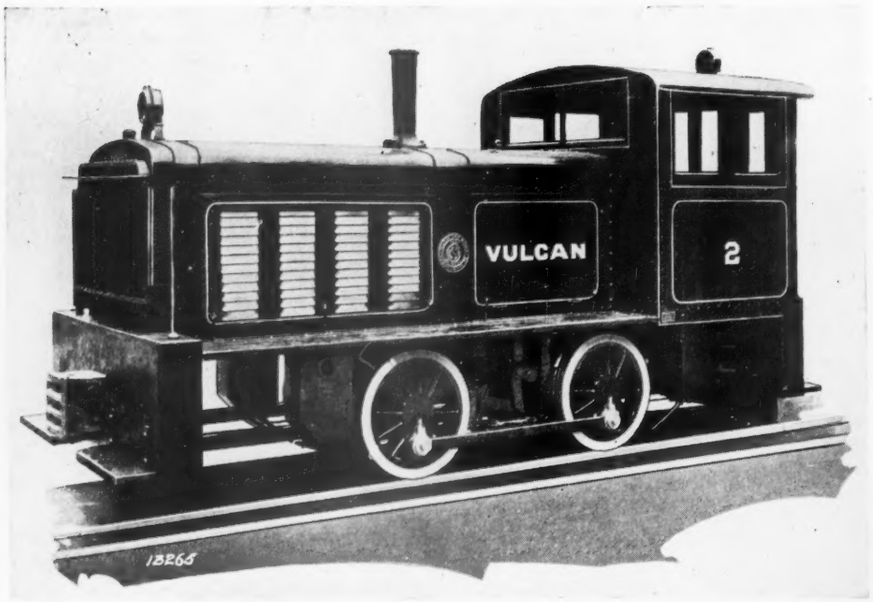
Because no manufacturer created the demand for or had the ability to design a transportation unit to connect up this human shovel with the huge crusher, in both of which thousands of dollars are invested, the quarryman has been satisfied to use his old hand-loaded type of cars, or at best the shovel's old dirt-handling receptacle.

About five years ago, however, at least one manufacturer realized that here was both a problem and a market. That if a company could create the supply the quarryman would create the demand. And today there can be had all steel cars of types in every way competent to meet the demands of the largest shovel, and carry its output to the jaws of the powerful crushers.

Quarry Cars Developed by Research

The vision required was large and the work it entailed stupendous. A photographer was employed for several months to go from quarry to quarry to photograph actual installation as the best means to lay before quarrymen the actual conditions and the cars used in different instances to meet them.

Present and back numbers of trade papers were searched for pictures and descriptive articles of actual installations. Of particular interest were installations of equipment that were best standing up under present



A new 12-ton locomotive made in all gages and particularly adapted in the standard gage size for switching railroad cars

conditions and the determination of the reasons why. With such information backed up by records and experience covering the designing of industrial cars over a period of 25 years, the determination of the essential features for cars to meet the exacting requirements of present-day quarry cars, where hand- or shovel-loaded were soon established. These designs and type of cars are today recognized as the standard by quarrymen and are copied by other car manufacturers.

Transportation Equipment

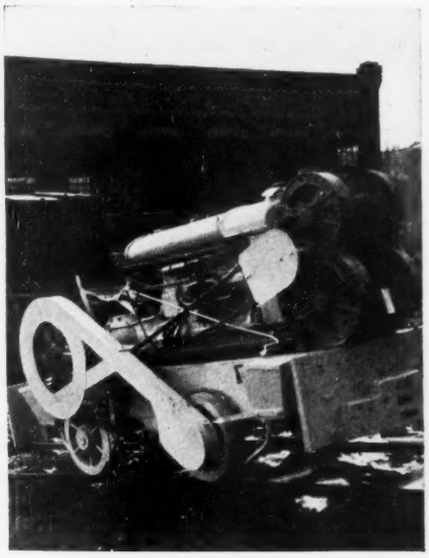
THE notable improvements in transportation equipment for the rock products industries have been the advent of the larger sizes of locomotives driven with gasoline engines. This appears to be a stage of the regular development of these machines. Starting with weights of from 4 and 7 tons they have progressed to the 20 and 30-ton stage and apparently the end has not been reached.

Some of the newer locomotives, however, are not of the greatest weight, for the small and medium-sized machines are as necessary as the large ones. The Fate-Root-Heath Co. has brought out a 12-ton locomotive after developing a 20-ton machine, both these being products of 1925. This 12-ton size seems to be well adapted to quarry and gravel pit work and it is made in all gages from 23⅝ to 56½ in.

The Vulcan Iron Works has also added a 12-ton gasoline locomotive to its line. (The 20-ton locomotive was described in Rock Products, August 22.) This machine is made in all standard gages and the makers say that the standard gage model is particularly fitted for switching. It is equipped with spring draft rigging, which is furnished in the bumpers with M. C. B. automatic couplers, to take up the shocks of coupling and pulling heavy railroad cars.

The Davenport Locomotive Works has begun the manufacture of a 4-ton locomotive, thus completing its line from 4 to 20-ton machines. The 4-ton machine is powered with a Fordson tractor engine which runs on kerosene. The speed range is from three to 14 miles per hour.

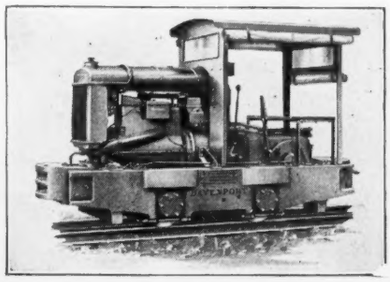
The Milwaukee Locomotive Manufacturing Co. has added two large sizes to complete its line from 4½ tons up. These new machines weigh 18 tons and 20 tons and they are built for all gages from 30-in. to 56½-in. This machine has speeds of 2, 4, 6 and 12 miles per hour both forward and in reverse. A cut of the power plant is shown.



This gasoline hoist carried by a gasoline locomotive is a novelty in transportation equipment

The George D. Whitcomb Co. mentions an Australian installation (at the David Mitchell Estate, Lillydale, Victoria) in which a 7-ton Whitcomb locomotive is put to an unusual variety of uses. All the material at the plant, stone, burned lime and coke, is handled into and out of the plant, including the charging of the kilns, by this machine. This company has just added a 22-ton locomotive to its line which

A third-rail electric haulage system. The movement of the cars is controlled by an operator who stays in the tower shown in the center

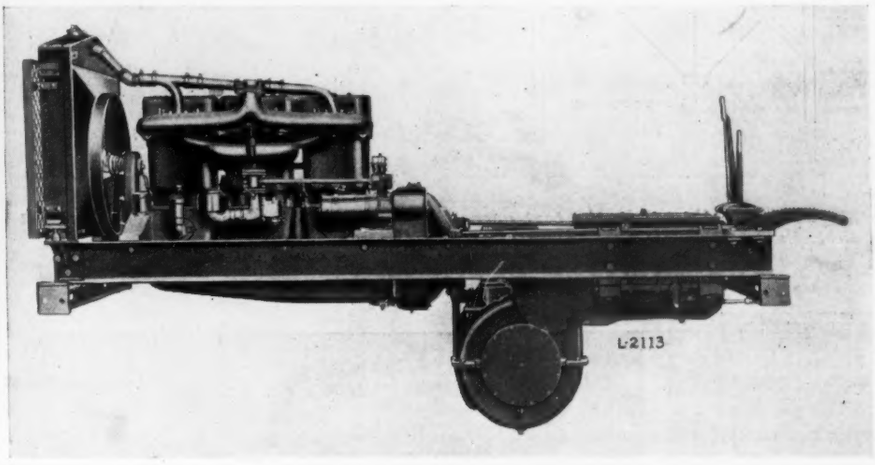


A new 4-ton locomotive powered with a Fordson motor

it recommends where a gas locomotive is wanted to haul heavy loads over long distances or over heavy grades. It has a 132-h.p. Climax, or Beaver, 6-cylinder motor.

The Brookville Truck and Tractor Co. report a decided novelty in transportation equipment. This is a double-drum hoist mounted on the standard Fordson driven locomotive of this company's make. The hoist is used to pull quarry cars up an incline from a limestone quarry and the locomotive then takes them over a half-mile track. This is at the quarry of M. M. Ornsdorff, Strassburg, Va.

Advance in quarry cars is illustrated by two cars brought out in 1925 by the Easton Car and Construction Co. called the "Phoenix" and the "Won Way." The Phoenix car has no door, its important feature being the design and construction which is planned to resist the heaviest loading shocks. The Won Way car is also designed to receive shocks and it has a door which is flush with the bottom when the stone begins to move, so there is no danger of a hang-up or of the car dumping off the tracks into the crusher (illustrated on page 174).



The power plant of a new gasoline locomotive made in 18 and 20-ton sizes

The Woodford haulage system has been installed in some of the most important rock products operations of the year. This method was pretty thoroughly described in the article on the Verplanck quarry of the New York Trap Rock Corp., published in Rock Products, June 13, and the description of the Trinity Portland Cement Co.'s Fort Worth plant, published November 28. This system is growing in favor with operators who can afford to plan for efficient long-time operations.

The aerial tramway has not been largely applied in the rock products industries as yet, but its use is increasing and some notable installations were made in 1925. One of these was at the gypsum quarry of the Blue Diamond Co., near Arden, Nev., and it was described in Rock Products for July 25. Another was at Nephi, Utah, to bring gypsum from a new quarry of the Nephi Plaster and Manufacturing Co. to the mill. 9500 ft. away in an air line. The country is so rough that no other method of transportation could be used. The Celite Co. also installed a long aerial tramway at their quarry in Lompoc, Calif., after considerable experimenting with other methods of transportation. All these tramways were made by the Interstate Equipment Co.

Conveyors and Elevators

SHAKER conveyors are not unknown in the United States but their use is by no means as common as in Europe, where they are often used to handle hot materials and substances that would injure a rubber belt. F. L. Smidth and Co. introduced such a conveyor in the past year, the first installation being made at the plant of the Kansas Portland Cement Co. at Bonner Springs, Kan. The cut shows the operation of the machine. It takes the hot clinker from the coolers and delivers it to the elevator.

In belt conveyors the big advance is the increased use of ball and roller bearing idlers for belts. These are not new but new designs have been brought out. The Stephens-Adamson Co. introduced its "Sacon" idler, which is of this type and which is made in sizes up to 48-in. in width. The outer brackets are hinged and the ball bearings are built on the line-shaft principle, since this gives a greater "fatigue life" to the bearing. The hinged joint in the supporting bracket makes the bearing readily accessible and facilitates inspection and renewal.

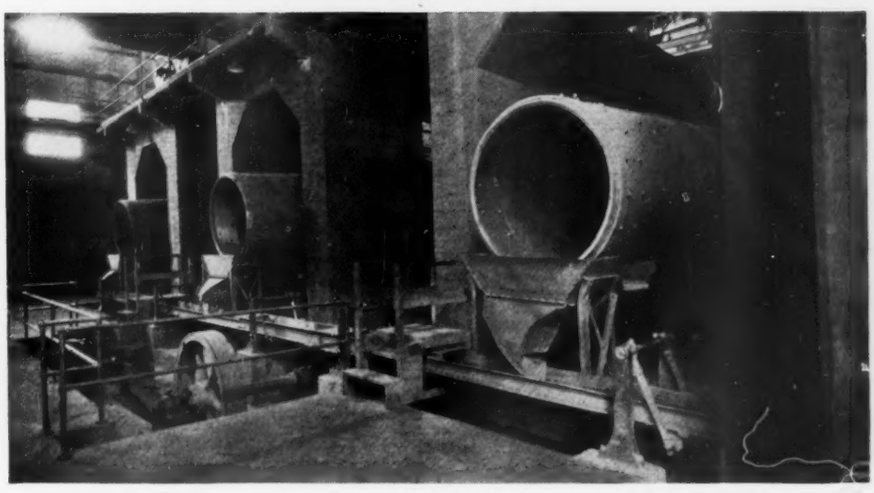
The Robbins Conveying Belt Co. has brought out a new type of roller bearing troughing idler. Its features are not only friction saving and high pressure lubrication but ease in demounting and the possibility of interchange.

The use of the ball and roller bearing idlers has worked a great revolution in belt conveyor practice. It is possible to lengthen conveyors to nearly twice what was considered standard practice only a few years ago, as the friction on the idlers is less than half of what it was before such bearings were introduced. In conveyors of ordinary length lighter belts may be used with safety and the wear on belts is much less since there is little or no danger of an idler stopping, which has been a common source of belt wear.

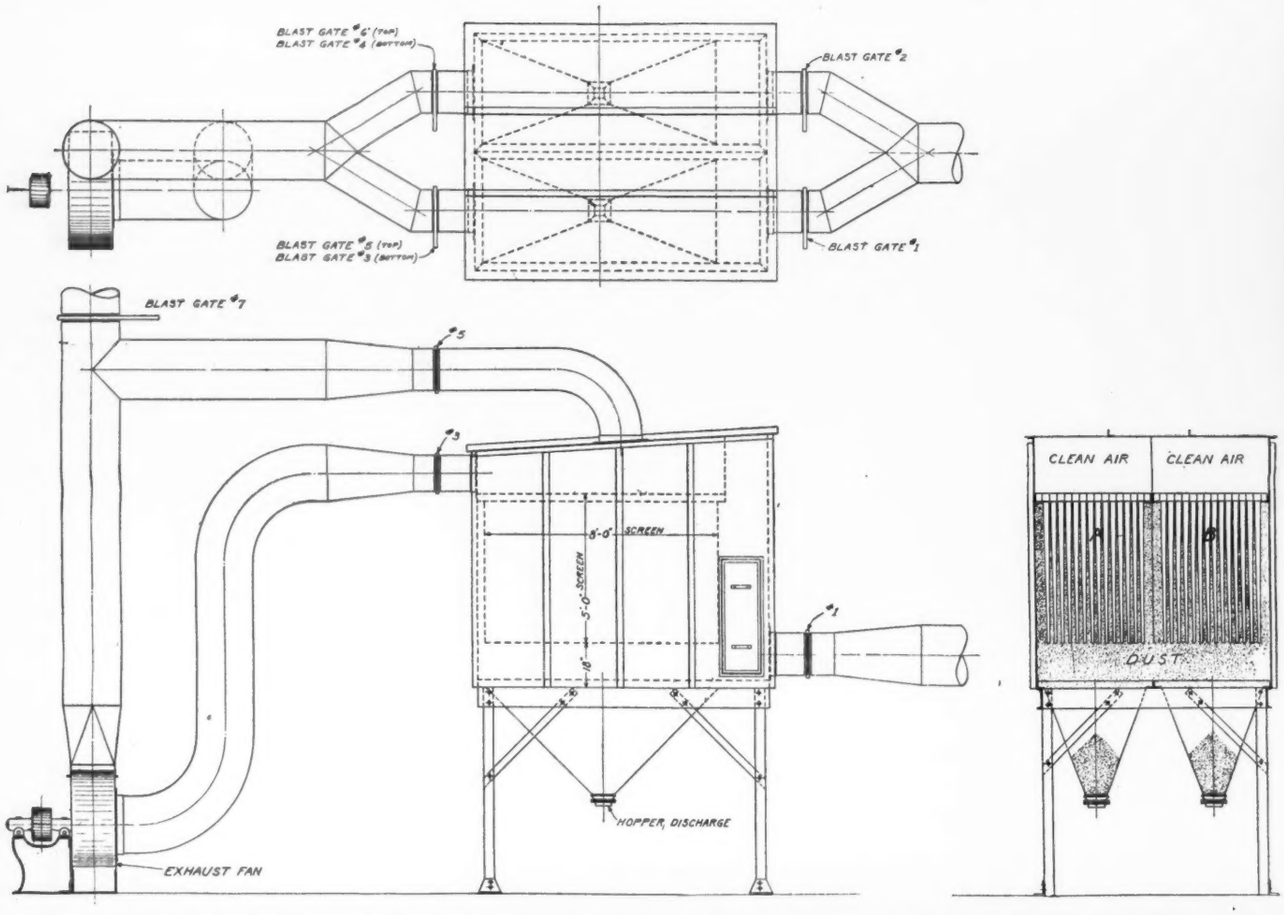
No manufacturer reported any improvement in elevators this year. The elevator, like the belt conveyor, seems to have been developed about as far as is possible without making very radical changes.

Gravity or roller conveyors are being used in the rock products industry to move gypsum blocks, cement blocks and the like.

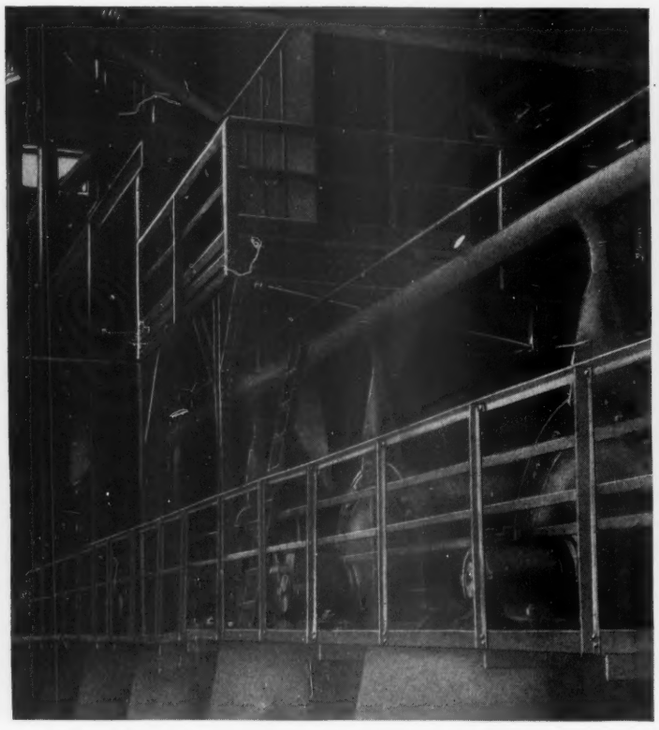
For conveying fine materials there is an increasing use of methods which use air in some way. A description of the Fuller-Kinyon pump for pulverized coal and cement is printed elsewhere in this issue.

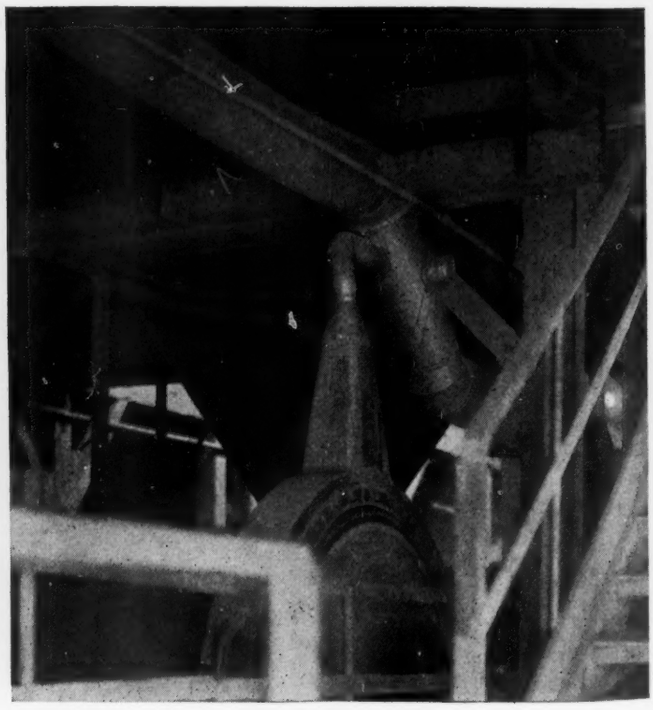


New type of shaking conveyor which takes hot clinker from the coolers of a cement plant and delivers it to the hot elevator

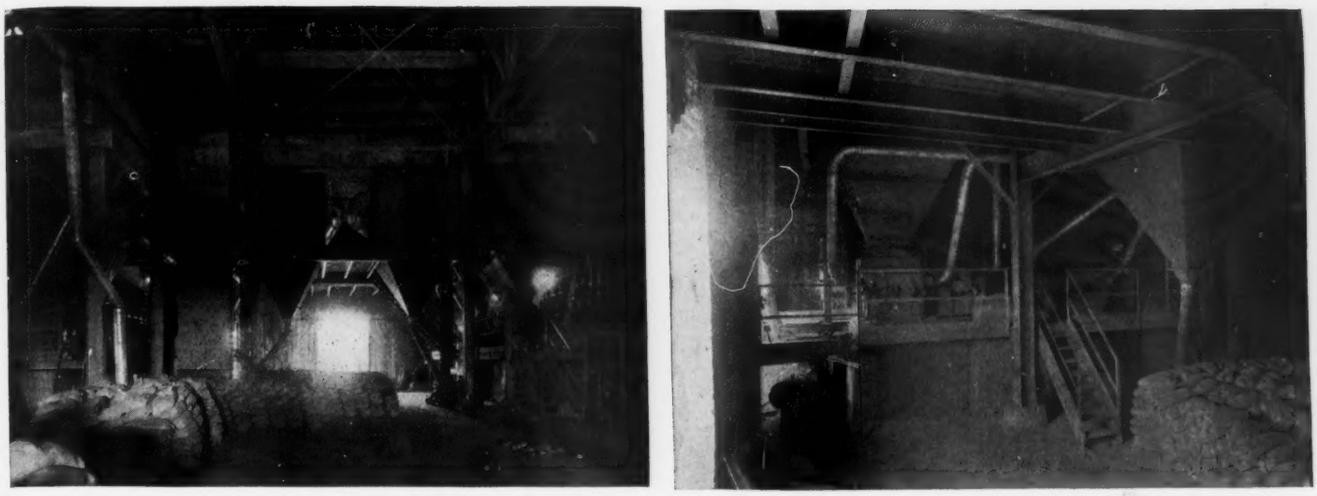


Plan and elevation of self-cleaning cloth type dust collector. In the text accompanying this it is explained how the dust collecting screens in each section are cleaned by reversing the air current





Left—Self-cleaning type of dust collector applied to finish grind mills in the Lawrence Portland Cement Co.'s plant at Siegfried, Penn. Right—Close-up of stack and connection to finish-grind mills



Left—Self-cleaning dust collectors installed in packing plant of Lawrence Cement Co. Right—Close-up of packer and dust collector

Dust Conveyors and Collectors

DUST collectors and conveyors have had a more extended use in 1925 than before. They are now regarded as indispensable in localities in which their use was not thought of until recently.

One of the developments of 1925 in these machines was the self-cleaning cloth type dust collector introduced by the J. W. Paxon Co., Philadelphia. It was designed to eliminate moving parts that would be cut by abrasive dust and thus have a short life. It has also a self-cleaning feature by which the cloths which catch the dust can be cleaned and restored ready for use in 20 sec.

The normal operation is shown in the accompanying line cut: Dampers 1, 2, 3, 4 and 7 are open and dampers 5 and 6 are closed.

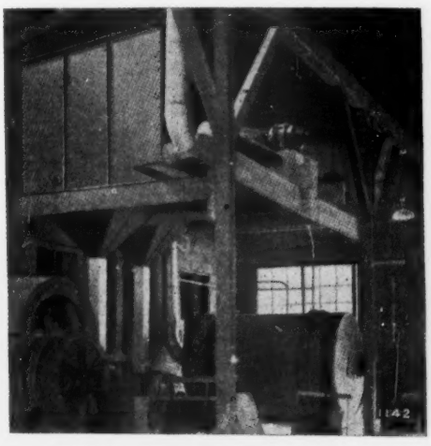
When it is necessary to clean the cloth screens in section "A," dampers 1, 3, 6 and 7 are closed. Dampers 2, 4 and 5 are open. To clean the screens in section "B," dampers 4, 5 and 7 are closed and dampers 1, 3 and 6 are open. In each case this sends a reversed current through the screens so that the dust falls to the hoppers below.

The photographs show the Paxon collector installed at the plant of the Lawrence Portland Cement Co., Siegfried, Penn. They were taken with the machinery in operation which shows the air to be free from dust.

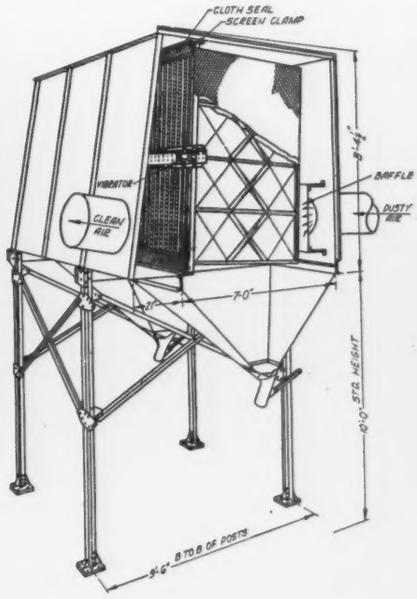
The Sly positive dust arrester, made by the W. W. Sly Manufacturing Co., is not usually thought of as an air separator since its great use in the rock products field is the collection of dust in cement plants and rock crushing plants. A notable installation in a cement mill was that at the Peerless plant, described in the story published September 3. But it may be also used as a separator in connection with grinding mills and an installation made at a plant grinding feldspar is shown here. The finely ground feldspar from 200 mesh down is sucked out of the mill and caught in the dust collector and discharged at intervals by the rapping mechanism.

The "Gayco" separator, made by the Rupert M. Gay Co., is not an air separator in the sense that it makes separations by varying currents of air. It is rather a centrifugal machine employing the air as a medium to hold the grains, and a whirling motion is imparted to the whole mass. Hence centrifugal force does all the separating. Some important installations were made in the rock products field in 1925, among which were those in roofing granule plants in which the machines recovered granules and mica which would otherwise have been sent to waste. The makers of this machine say that they have made no change in the standard design this year but they will shortly introduce a separator which will be fed with a blower instead of an elevator.

The American Foundry Equipment Co. write that they have re-designed their cloth screen dust arrester and the details are given in the accompanying line cut. The basic principle is the same, but the new form of construction makes it easier to get at such parts as might need repair. The makers say that in connection with cement plant work these machines save thousands of tons of cement that would otherwise float out in the air and become a nuisance.



Positive dust collector employed to collect ground feldspar



New design of cloth screen dust arrester

In the illustration on the next page is shown a piece of equipment that has been used successfully for recovering non-soluble dusts from air coming from grinding, calcining, or drying machines. It is known as the Christensen tangential spray machine and is made by the Hardinge Co., York, Penn. In its operation, smooth surfaced rotors, running at high speed, throw off a continuous shower of small particles of water, or other liquid, which wet the dust particles to be collected. The lower part of the rotor dips the water or whatever the liquid may be

Tangential spray machine used for collecting dust

The gas or air loaded with fine particles that it is desired to remove, passes into the chamber over the rotors. The bottom of this chamber forms the bath into which the rotors dip. The liquid level in this bath is maintained at a constant, pre-determined point by a regulating valve and a check float valve.

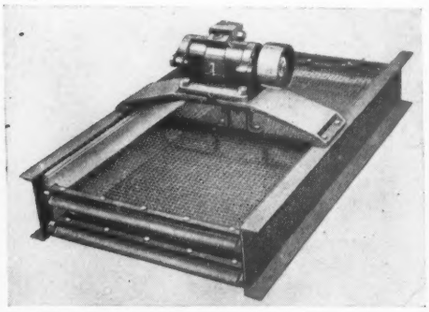
The rotors are each connected directly to a ½-h.p. motor running at 875 r.p.m. The level of these rotors can be adjusted by screws. If the dust is soluble, a continuous overflow of concentrated liquor may be obtained by arranging a gooseneck to discharge on a level with the bath in the chamber. Intermittent discharge is possible by maintaining the gooseneck pipe in an upright position except when it is desired to withdraw liquor. A modified form of apparatus has been used successfully for the recovery of non-soluble dusts from air from grinding, calcining or drying machines in various rock products and mining plant operations.

Screening and Separation

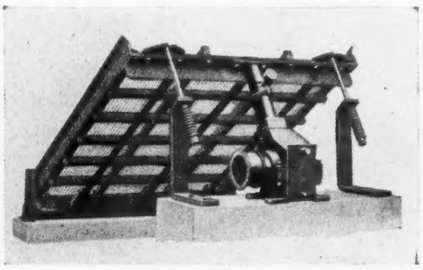
THE improvements in screening and separating machinery appear to be largely confined to those which make separations of the finer mesh size, both in the wet and dry way. Air separation is developing and is increasing in favor. It has so many advantages over screening for the fine sizes that a much increased use may be looked for in the future.

A line of separators which is almost new in the rock products industries is that of washers for coarse material such as crushed stone and gravel. Of course log washers and washing cylinders have been used for a long time in washing phosphate rock, but the changes in design necessary to adapt these to gravel washing, for example, are only just beginning to be made. Two machines which embody these changes appeared in 1925 and they are reported to be meeting with unusual success.

In grizzlies and coarse screens no improvements have been noted. There is an increased use of grizzlies of the rotary and cascade type, especially to use them in the place of screens in the sizes between 1½-in. and 2½-in. Installations of the Telsmith rotary grizzly and the Robbins "Cascade" grizzly have been made with that end in view. Such use of the "Cascade" grizzly is noted in the review of the crushed stone industry in this issue.

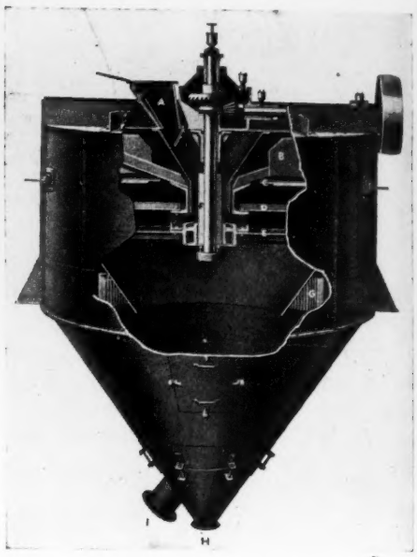


A new vibrating screen in the two-surface model



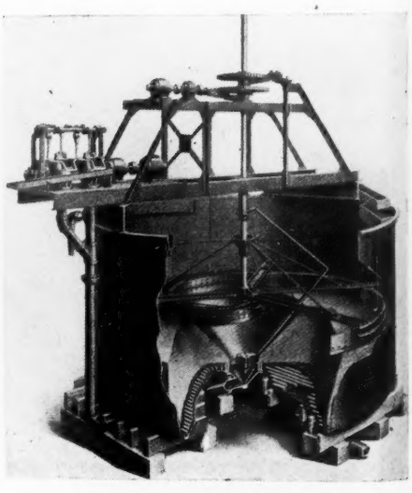
A heavy duty screen especially designed for crushed rock and gravel

One new vibrating screen has been brought out, the Leahy "No-blind" screen, made by the Deister Concentrator Co. It was described in the issue for March 7. The model described then had but a single screening surface, but it is being made now with two screening surfaces, both of which are vibrated. Another new type of this screen has an electric drive, the motor cam and gearing being mounted on the frame work in a dust-tight covering. It can be connected to an ordinary lamp cord. The makers of this screen recommend it for all sizes from 1½-in. to 50 mesh.



Air separator to be used on 50-mesh and finer separations

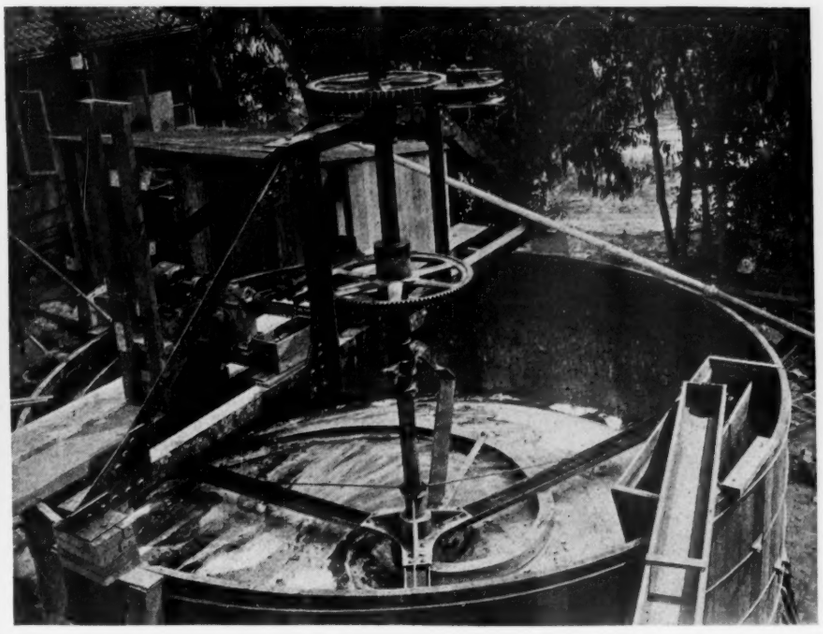
The Sturtevant "Moto-Vibro" screen was not brought out in 1925 but it was developed in the past year. The Sturtevant Mill Co., which has been making screens 40 years (including some very successful types like the Newaygo) say that the Moto-Vibro represents their accumulated experience. Not the fabric alone but the screen and fabric are vibrated. The usual machine is made with three screening surfaces vibrated by



A sectional view of the new thickener with filter bottom

one mechanism. This is especially adapted to medium and fine screening.

The new type of this screen is a heavy duty model, built for the severe work of screening large tonnages of crushed rock and sand and gravel. It has but a single surface ordinarily, although it may be built for two. It is shown here in the skeleton form but it is also made with complete dust proof covering.



The new "superthickener," showing the way in which the blades collect the material

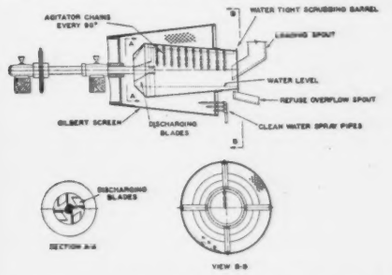
The Sturtevant company does not recommend screening for the finer sizes. For material finer than 60 mesh, or perhaps 80 mesh in some cases, it prefers to use air separation. It has recently brought out an air separator that has important advantages over some of the older designs. These are, that only low speed air currents are employed so that there is no "sand blasting" effect, and, as the moving parts run at comparatively low speeds, there is less wear on the bearings. The machine has a centrifugal drum on which the grains are collected, the heavier grains going to the outside and the lighter to the inside. The grains are sucked or blown off by air currents and as both the speed of the drum and the force of the air current may be regulated any desired separation may be obtained. The machine can work on material from 30 mesh to 350 mesh.

In thickeners the great improvement has been to combine filtration with thickening. The idea is not new as there have been machines to do this on the market for a good many years. But the way in which the principle applied is new.

The Hardinge super-thickener, made by the Hardinge Co., applies both filtering and thickening. The bottom of the thickener is covered with a sand filter. The material which is thickened in the ordinary way settles on this and is further dewatered by the filtering action. The solids are continually scraped off the filter and discharged as in other thickeners, but owing to the filter action very high percentages of solids in the discharge may be obtained, as much as 80% to 90% in some cases. Arrangements are included for cleaning the sand filter which has to be done at periods varying from a few months to two years.

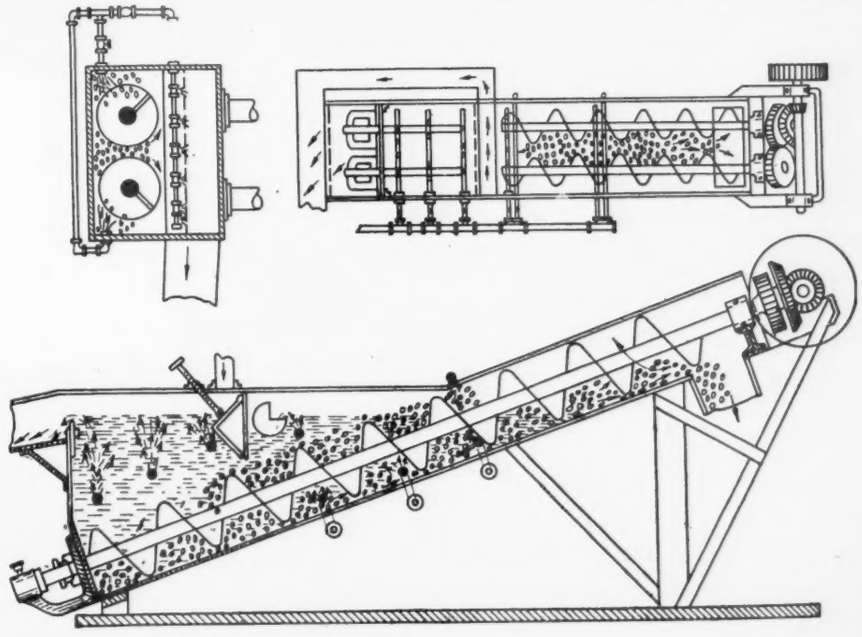
The Dorr thickener was much improved this year by a change to a peripheral drive which would seem to be the logical drive to apply to so large a mechanism. It was described in Rock Products for September 19.

Two new washers for separating trash (sticks, leaves and roots) and mud balls from gravel appeared in 1925. One of these the Eagle gravel washer, made by the Eagle Iron Works, has already been described (Rock Products, February 7). It consists of an inclined cylinder with a screw inside which forces the gravel uphill and turns it over and over at the same time. A stream of water flowing down hill over the gravel removes the trash and mud as it is brought to the surface. Several installations of this machine have been made in 1925 at gravel plants and experiments are being made in a crushed-stone plant which promise success.



A new scrubber which is placed inside a screen of the "Gilbert" type

The other gravel washer is the "Perfect" classifier, made by the Perfect Classifier Co. It is a double log washer with a high overflow which permits the carrying of a body of water in the lower part of the machine and hence the use of rising current water coming through the gravel to rinse as well as wash it. The most interesting feature of the machine is the skimmer with which it is provided. This lifts out the trash and lignite which would otherwise block the overflow without being carried out. The machine, although quite new, has been installed and is reported to be working well.



A new gravel washing machine combining a double log washer with an overflow and skimming device

The engineers of the Stephens-Adamson Manufacturing Co. have made a very ingenious combination of a scrubber with the well-known Gilbert screen which they manufacture. It consists of a steel barrel securely mounted inside of the standard 84-in. screen. Chains are hung in this which thoroughly agitate and scrub the material. At the far end of the scrubber are elevating vanes which lift and discharge the material into the screen, where it is not only separated but given a further wash. This machine apparently has advantages over the obvious one of saving space, one of which is that of providing an excellent feed to the screen.

The Dings Magnetic Separator Co. has designed and placed on the market a new small magnetic pulley.

This machine can be used with the small high-speed grinder, protecting it from the damage which results from tramp iron and the dangers of throwing sparks and resultant explosions.

The separator is a simple device of the trough type and can be installed quickly and easily in the feed to the crusher or grinder.

The magnetic coil is completely enclosed and is out of the way under the separator. The magnetic plate itself is placed above the coil and holds the iron as it passes down the trough in the material. A pivoted gate mounted with a coil spring forms part of the bottom of the trough below the magnet.

Turning on the current closes this gate through the power of the magnet. Thus, when the current is off the spring opens the gate, the magnet lets go and the captured iron slides down, bumps on the gate, and is turned aside into a basket, or other catch-all.

A special d.c. generator has been designed to go with the device.

The Magnetic Manufacturing Co. has brought out a new type of its "high duty" separator which is adapted to double beaded apron conveyors.

Development of Speed Reducers

By E. J. Patton

With the Stephens-Adamson Manufacturing Co.

[Owing to the great interest in speed reducers and the developments in these machines, the following article has been prepared for Rock Products. It is wholly a description of the basic principles of the design and use of speed reducers and not a description of any particular make. The reader will note that one type of speed reducer may be better adapted for a particular condition than another, a point that will be better understood after reading what follows.—The Editors.]

THE electric motor has been developed to the point where it is unquestionably the most satisfactory and economical source of power for the average plant. It is light, compact, powerful and ideally adapted to individual drives. No matter how secluded the location, electric current is usually available.

The one difficulty involved is the comparatively high speed at which this power is delivered. In practically every case, mechanical means must be employed to step down the rotative speed to suit the machinery to be driven. There are two ways of accomplishing this reduction: first, by means of a train of gears, belts, chains or a combination; or second, by using one of the devices known to the market as speed reducers.

The open gear train, the first mentioned of the expedients for stepping down speed, while cheapest in original cost, has several serious drawbacks. It is an ever present source of serious accident; it requires constant attention to lubrication and adjustment; it takes up considerable space, often requiring a special supporting framework which is sometimes hard to build into the average installation.

Open gears are hard to lubricate properly, and when exposed to dust and grit soon wear to the point where they vibrate and pound excessively. All this of course helps to decrease the working efficiency and power delivered. This loss in power is usually estimated at 10% for each set of gears in the drive. As the reduction ratio of a single pair of gears (or sprockets) is seldom over 6:1, the ordinary drive consists of three or more sets of gears, with an estimated loss of at least 25% of the power generated by the motor.

On the other hand the self contained "speed reducers" have many counts in their favor. They are *compact, absolutely safe, easy to mount, require little attention* and are far more efficient than the open train because being totally enclosed in dust and oil tight casings they are operating under ideal conditions at all times. The reducers differ considerably in their rated efficiency, or percentage of the generated power which actually reaches the machinery to be driven. With most of the spur gear types of reducer it is safe to count on an efficiency of 80 to 90% for the average drive. This means an actual gain of 5 to 15% in power which can be put to *useful* work—an item also worth consideration. It is true that the speed reducer costs more than the open gear train; but on the other hand, it will last longer.

Assuming that the plant superintendent is convinced of the superiority of the speed reducer over the open gear reduction, there remains the question, "Which type of reducer shall I use?" There are at present five general types of reducers in common use: the worm gear type, the planetary spur gear type, the internal spur gear type, the simple gear train type and the counter shaft type.

It is impossible to recommend any one type, because each has its place and is well suited for various installations. Taking each type in turn we will try to give the principal advantages and limitations, so that the reader may make his own comparisons.

The Worm Gear Reducer consists of a steel worm rotated by the electric motor and a special gear which in turn is rotated very slowly as the threads of the worm push the teeth ahead. To turn (as an example) an 80 tooth gear around once, a single thread worm must revolve 80 times, a double thread worm 40 times and a triple thread worm 26⅔ times. Both gear and worm are enclosed in a compact, rigid, oil tight housing. The motor is connected directly to the worm shaft by a semi-flexible coupling, and the gear shaft is connected in the same way to the machinery driven. Ball thrust-bearings are usually provided on both ends of the worm shaft to take up the end thrust in either direction. The speed reduction necessary is accomplished by varying the teeth in the gears and the number of threads on the worm. Reductions of from 135:1 down to 6:1 are obtainable. Sizes vary from reducers capable of delivering fractional horsepowers up to those delivering 75 or even more.

Because of the sliding action between the gear teeth and the worm threads there is considerable friction with a consequent heating of the gears. For this reason this type of reducer is not generally advised for heavy continuous service, even though operating in a bath of oil. The power actually delivered is a comparatively low percentage of motor input (from 80% to as low as 30% for the greater reductions).

On the other hand, the worm gear reducer is simple and comparatively cheap. It is light and very compact, considering the reductions possible. In many cases, it is very convenient to mount because of the two shafts being at right angles to each other. By removing the upper half of the housing the gear may be inspected without disturbing mounting, bearings or couplings.

The Spur Gear Reducer (planetary type) consists of a high-speed pinion meshing with three planetary gears which mesh inside a larger stationary internal gear, similar in action to the reduction in the steering wheel of a Ford car. As the high-speed pinion revolves the planetary gears, they travel around inside the fixed internal gear. A spider (upon which they are mounted) in traveling with the three pinions rotates the low speed shaft. Diagram No. 1 illustrates a single reduction. Higher reductions are obtained by double, triple or quadruple sets of reductions operating about the same axis, the low-speed shaft of one turning the high-speed pinion of the next, and so on. Reductions range from 4:1 up to 200:1 and machines are built in sizes to transmit from

fractional horsepowers on up to 50 or 60 hp. in the medium reductions.

Operating as it does on the planetary principle, there has been some objection to this type of reducer on the grounds that the teeth mesh at a speed which is too high, considering the slow speed at which they actually travel, and that there is an excessive amount of impact with a consequent danger of the oil film not giving adequate protection. The three planetary gears are supported from one end only, but when rigidly fixed this should not cause trouble. To inspect the gears, bearings, etc., the ends must be removed, which usually necessitates moving the reducer from its position.

A saving of space is made possible by this type of reducer because since the high-speed pinion meshes with three planetary gears, the driving load is distributed and smaller, finer pitch gears may be used. For the reduction obtained and the horsepower transmitted, this type is probably the most compact. While it is more expensive than the worm gear type, the cost for average reductions is not excessive.

The Spur Gear Reducer (internal gear type) consists of a high-speed pinion which drives three fixed idler pinions, which in turn slowly rotate a large internal gear. The internal gear is fixed to the end of the low-speed shaft. This is a case of simple spur gear reduction in which one gear has internal teeth. By using three idler pinions the load is distributed and smaller gears are made possible. Diagram No. 2 shows the principle of the single reduction machine for low ratios.

Reductions are obtainable from 4:1 to as high as 350:1. Machines are made which will transmit fractional horsepowers up to 50 or 60 hp. for medium reductions and as high as 500 hp. for the lower ratio reductions.

As in the planetary type, the idler pinions are supported from one end only, but if the mounting is rigid, the teeth should have contact across their entire faces. The high-speed pinion driving the three idlers receives three times the wear, but if lubrication does not fail, it should have a long life. As regards accessibility, this type is about the same as the preceding and following types. To inspect bearings, gears, etc., the ends must be removed and the reducer has usually to be taken from its position.

This type is compact, probably rating next in size to the planetary reducer. Comparatively high reductions are possible. As in the planetary and following types, the distribution of the load from the high-speed pinion makes possible smaller gears.

Spur Gear Reducer (simple gear train

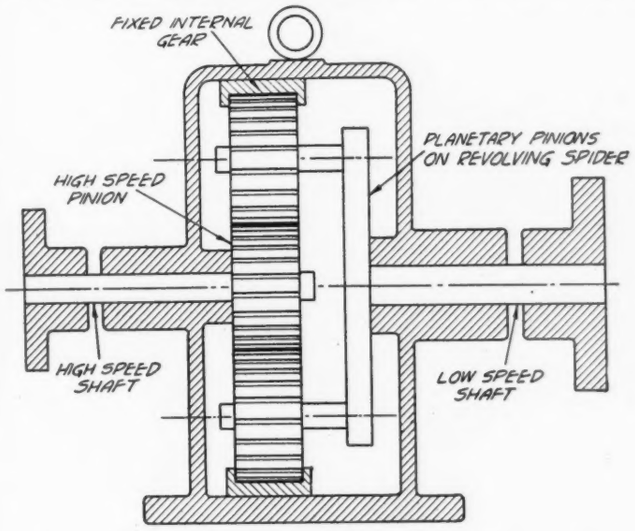


Diagram No. 1—Spur gear reducer of the planetary type with stationary internal gear

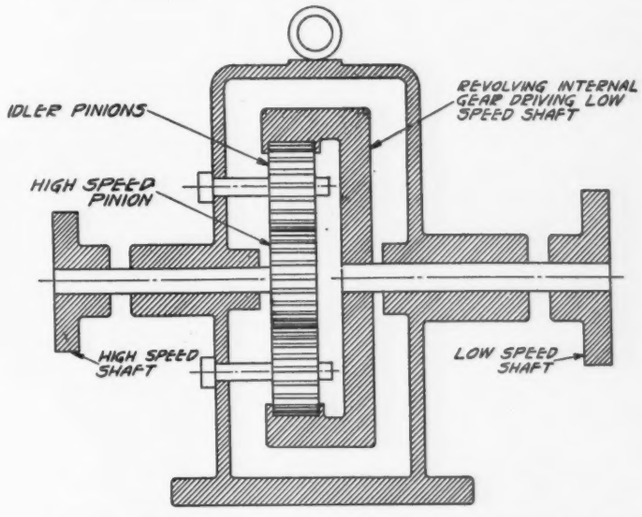


Diagram No. 2—Spur gear reducer of the internal gear type in which the internal gear rotates

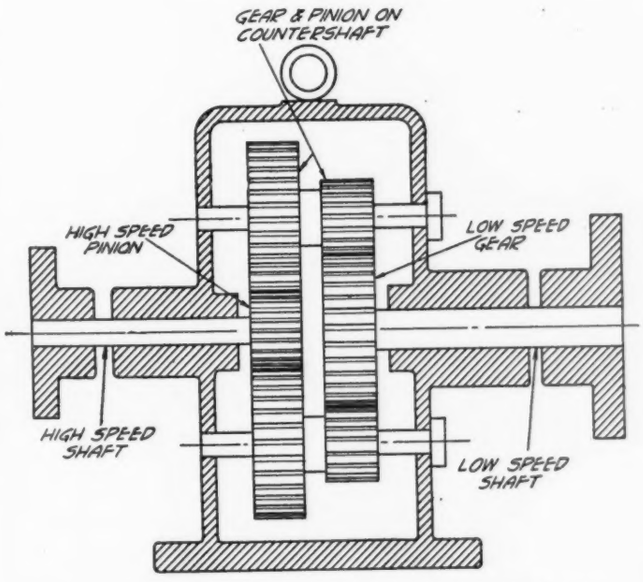


Diagram No. 3—Spur gear reducer of the simple gear train type

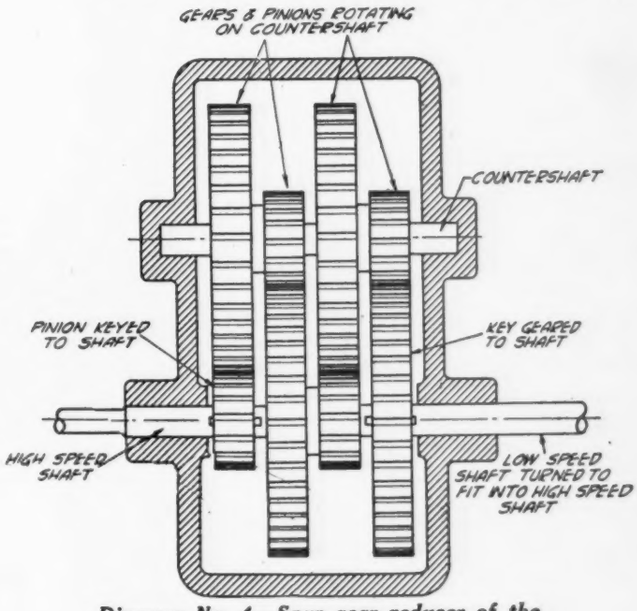

GEARS & PINIONS ROTATING ON COUNTERSHAFT
COUNTERSHAFT
PINION KEYED TO SHAFT
KEY GEARED TO SHAFT
HIGH SPEED SHAFT
LOW SPEED SHAFT TURNED TO FIT INTO HIGH SPEED SHAFT

Diagram No. 4—Spur gear reducer of the countershaft type

type). In this type of reducer the high-speed pinion drives three large gears each mounted on a shaft supported at both ends. Fixed to each gear and on the same shaft is a pinion which rotates with it. These three pinions in turn drive a large gear mounted upon the low-speed shaft. Diagram No. 3 shows how a double reduction is obtained in a rather small space. Reductions of 3:1 up to 200:1 may be obtained. Small machines are made in sizes capable of transmitting fractional horsepowers and the larger machines can handle to 150 hp. at the lower reductions.

This type is usually slightly larger and heavier than the two preceding types for a given reduction and the same strength. It is similar to these types in that the ends must be removed for inspection and usually the reducer must be moved from the mounting. The essential features of this type are the same as those of the previous type, except that internal gears have been eliminated and, theoretically, all gears can be supported at both ends, thus insuring that each tooth will mesh across its entire face. The efficiency is quite high and rates close to the two previous types.

Spur Gear Reducer (countershaft type). This type is probably the simplest, although it is not quite so compact as the others. Diagram No. 4 shows the principle of operation and how the gears and pinion of each reduction in the train revolve upon an adequate countershaft. Power is transmitted in each case by simple, wide face, coarse pitch gears. Lubrication is positive. Ratios are easily changed by substituting new gears in certain places. Reductions possible range from 2:1 up as high as 4000:1 in extreme cases. Standard sizes are manufactured which transmit from fractional horsepowers up to 500 hp.

The efficiency of this type of reducer runs up around 90% (or better in some cases). The design makes possible a two bearing support for each shaft, and for inspection it is necessary only to remove the cover, so that gears and bearings are not disturbed. It is not necessary to remove the reducer from the mounting. Where it is desirable to have great strength and the limit in efficiency these reducers are sometimes equipped with herringbone gears.

Size of Reducer. As the power absorbed in making the speed reduction is an important item in some types of reducers, it is well to remember this in choosing the motor. In other words, to the power actually needed, add the power likely to be absorbed by the reducer. Take the total for your motor size. Another factor to be taken into account is that it is often the practice to install, for example, a 15 hp. motor where the figured load is 12 or 13 hp., and as the motor is built to develop a considerable overload, it is wise to select a reducer to stand the *horsepower of the motor* rather than the horsepower actually *figured for the machinery to be driven.*

Power and Transmission Equipment

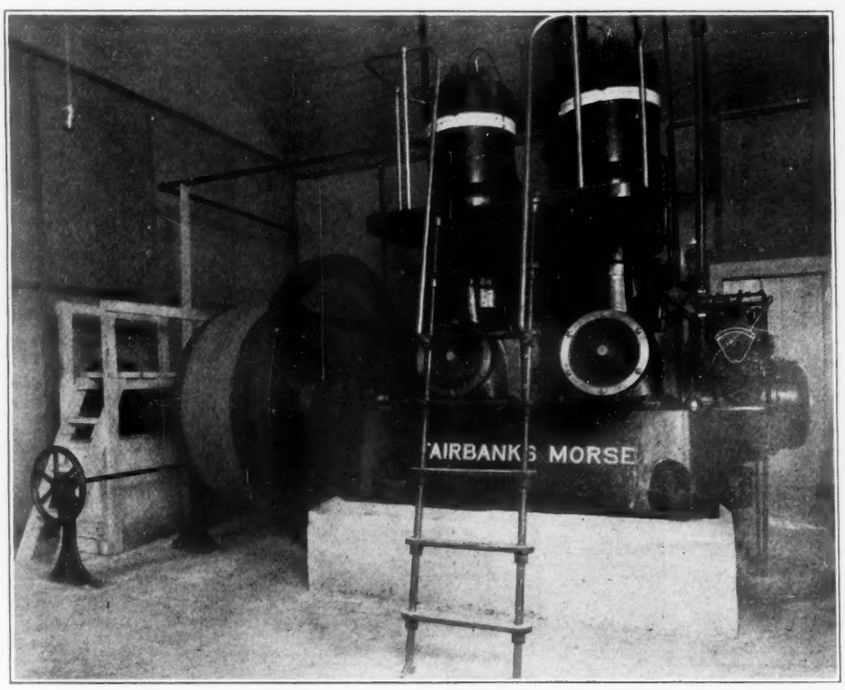
THE marked advance in power equipment for rock products plants in 1925 has been in the increasing use of oil engines for power, especially those of the full Diesel type. The application of this engine to power shovels and draglines was an earlier development, but in 1925 it has been successfully applied to the smaller sizes. How successful this application has been is shown by the fact that one manufacturer of Diesel engines has supplied these to excavating machines in 1925 to more than four times the horsepower which was supplied in 1924.

Power plants with Diesel engines and direct connected generators for running rock crushers and gravel washers are coming more and more into use. Oil engines of the low pressure type and engines employing gasoline and kerosene for power have not lagged behind, however, and they are being increasingly used for the smaller power units.

The application of steam to power production in the rock products field is most marked in the cement industry, where waste heat boilers are being installed in wet process plants in increasing numbers. The use of such boilers seems to be largely dependent on the cost of electric power at the plant. This matter is discussed at greater length in the review of the cement industry.

In electric motors perhaps the most marked advance of the year was the increased use of synchronous motors. These are now made in smaller sizes to adapt them to many drives for which induction motors were used before. The increased use of synchronous motors has raised the load factor of plants very markedly. The supersynchronous motor and the synchronous motor with contained clutch are the newer drives for heavier machines that need a high starting torque.

The increasing use of speed reducers in the place of belt and open gear drives was noted in the 1924 machinery review. This use went on in 1925 at an accelerated rate. Some of the newer plants have no other drives on the smaller machines. Of course belt drives are not obsolete and are needed where a machine is subject to heavy shocks. At least one important improvement in short center drives has appeared.



Full Diesel engine in the rock crushing plant of the Stigall Construction Co., Springfield, Mo. Conditions here permit direct belting to rock crushers

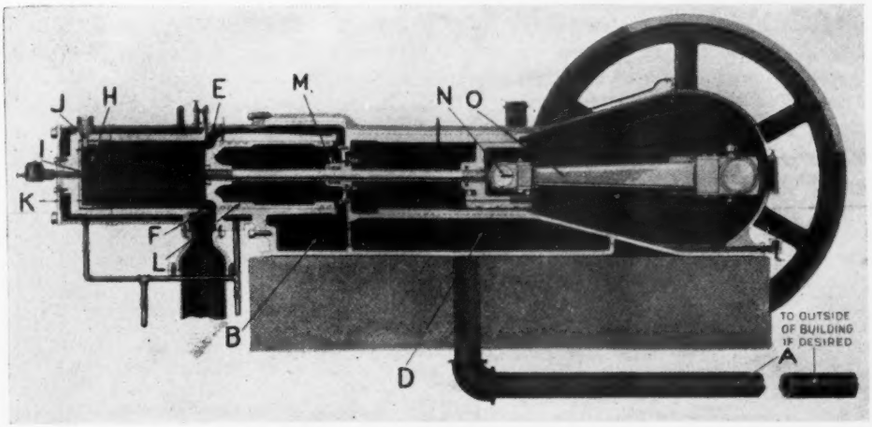
Turning to particular installations, Fairbanks-Morse and Co. have sold a great many full-Diesel engines to the rock products industries in 1925. The largest numbers were sold to crushed stone and sand and gravel plants, but producers of lime, talc and other products were also buyers. Installations were made both for generation of electricity and distribution of power through motors and also for direct drive. Where conditions are such that direct drive to the crushers can be

installed this is somewhat to be preferred as a crusher has to be driven with a belt anyway. An installation of this kind is shown in one of the accompanying cuts.

Several dredges were equipped with full-Diesel power, some of them for operating in the gulf states where oil is the fuel most easily obtained. The dredge, "E. T. Slider," which was illustrated in last year's Annual Review number, added a 240 hp. Fairbanks-Morse Diesel to its equipment, giving the dredge 540 hp. A good many of these engines were sold for towing sand gravel and stone barges, for both river and harbor service.

The manufacturers of the Fairbanks-Morse engines say there are two reasons why the Diesel engine is especially adapted to the rock products field. One, which everyone knows, is that it is cheap power, especially in localities where electric current is especially obtainable. The other is that it is the type of drive adapted to crushing machines and the like, having the same characteristics that kept steam power popular for this kind of work for so long a time. For example, it is not affected by comparatively heavy overloads lasting for a few seconds.

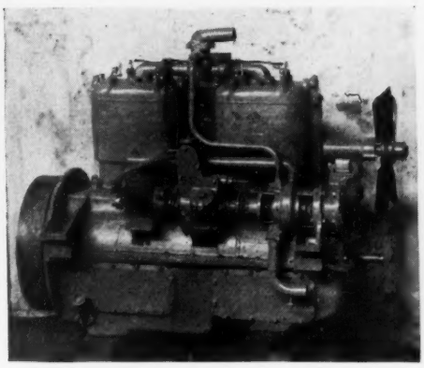
As to cost, the figures given for the Type Y engine at the Stigall quarry shown in the illustration are typical. This engine uses 4½ gallons of fuel oil per hour, costing 7 cents per gallon, and ¾ gallon lubricating oil in 10 hours, costing 63 cents per gallon, making the hourly cost 36 cents per hour for the 120 hp. engine.



This sectional cut shows the simplicity and strength of a new heavy duty low compression oil engine

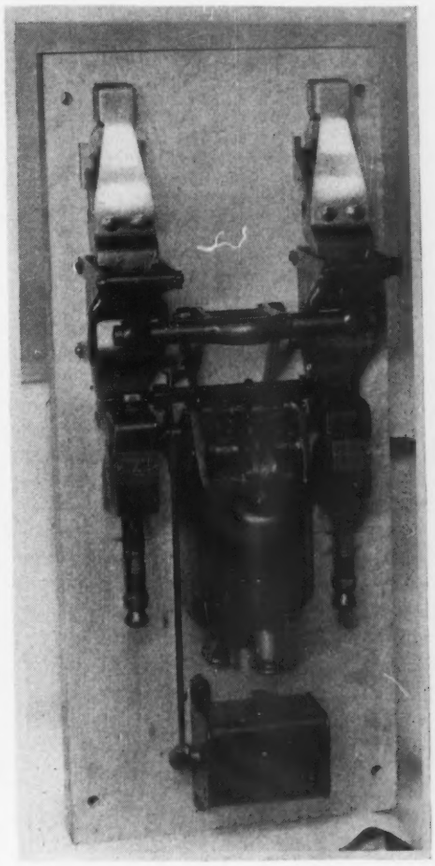
Meanwhile the low compression oil engine designers have not stool still. This is exemplified in the new heavy duty low compression oil engine brought out by the Power Manufacturing Co. This new type of the well known "Primm" engine is said by the makers to be especially adapted to generating electric current. Its simplicity and rugged construction are shown in the sectional view. This engine has a low oil consumption, the makers claiming that a kilowatt hour can be produced for about half a cent and that a gallon of ordinary oil will lubricate it for 1000 to 1500 hp. hours.

Among the engines using lighter oils and gasoline may be mentioned the Model KU Climax engine, made by the Climax Engineering Co. and described by them as a "portable power house." The Climax engine is well enough known in the rock products field because it is so much used in various makes of gasoline locomotives. This new form is an engine with radiator hood and panels completely equipped and ready to fasten down wherever power is needed. In the rock products field it might be applied to derricks, pumps, hoists, scrapers for stripping and in other places where power was temporarily needed.

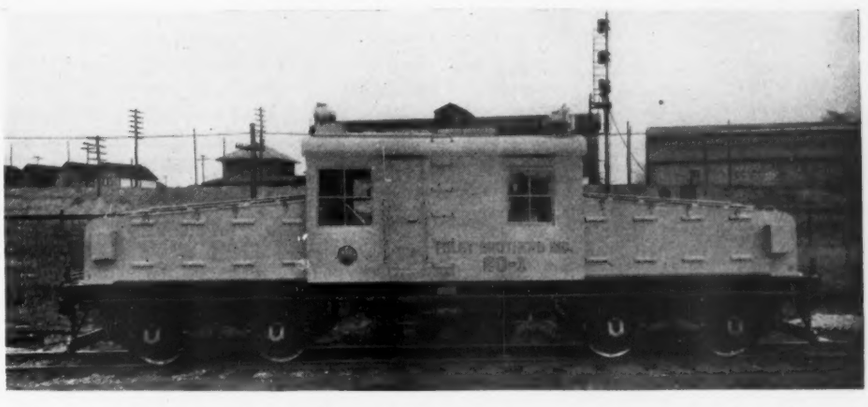


This engine is mounted with radiator, hood and panels to form a "portable power house"

The General Electric Co. notes that power shovels are now designed for electric power and not merely modified from steam shovel design, so that electric power is used on all sizes of shovels from those with ¾-yd. dippers to monsters with 90 ft. booms and a dipper of 10-yd.



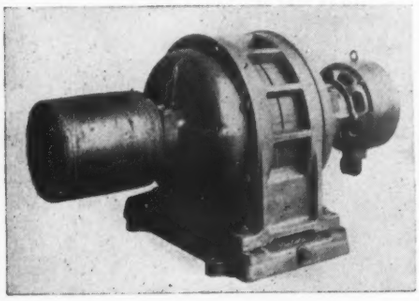
Double pole solenoid operated air circuit breaker with overload device for each pole used on d.c. and a.c. lines



New storage battery locomotive. It has a motor generator set in the cab, and while it is standing at the shovel the batteries are given a "boost" through a portable cable which is cut in on the power line

capacity. The shunt wound motor has been adopted, which makes the operation of the shovel simpler and permits the motors to be used as brakes.

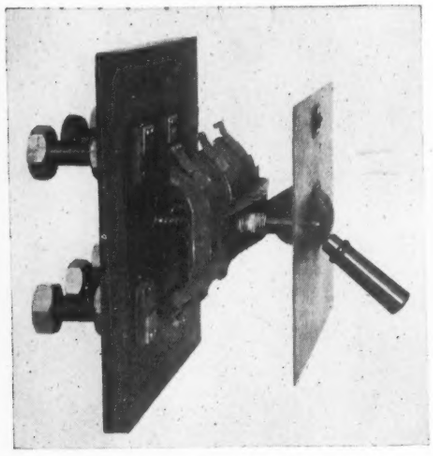
This company has devised gasoline-electric shovels for some cases in which electric power was not obtainable, using a



New synchronous motor which can be used where induction motors have been thought necessary

gasoline engine to drive a generator from which the electric motors on the shovel take current.

Storage battery locomotives have been developed by this company and one installation, used in coal mine stripping in Montana, is doing much the same work that it would have to do in the rock products field. Each locomotive hauls a train from the shovel to the storage pile and then brings back the empties for loading. During the loading period the batteries are given a boost from a cable carried on a truck which can be connected to the power line. This leads to a motor-gen-



New brush contact switch

erator set installed in the cab by which the batteries are charged.

The General Electric Co. has brought out a new line of synchronous motors in which standard induction motor parts have been largely used. It is said that the characteristics of these motors are so close to those of induction motors that they can be used for practically any general purpose drive.

A number of new control devices which will find a use in the rock products field have been introduced by this company. adapted to crushing machines and the like,

One of these shown here is a double contact air circuit breaker with overload device for each pole. It is used on direct current lines and also on 440-volt alternating current lines for all capacities up to 1200 amperes. When automatic, it is supplied with two overload tripping coils. Two other circuit breakers are shown, one with manual operating mechanism for oil circuit breaking, the other a new air circuit breaker shown in side view. The device known as a "Thermotel" is shown here in the form user with subway transformers, but a similar device is used with pole line transformers. Its use is to show the equivalent load on the transformers.

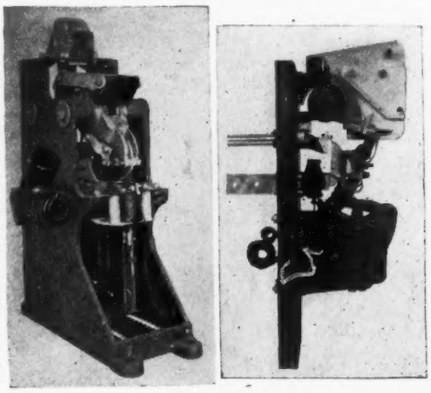
The "Thermotel," a device for showing load on transformers

The Westinghouse Electric and Manufacturing Co. has announced its new clutch type synchronous motor especially adopted for driving tube and ball mills. It is a combination of a synchronous motor of standard type with a magnetic clutch arranged to form a compact and self contained unit. Although this motor was put on the market late in 1924, enough were sold in 1925 to have a total rating of 20,000 hp., according to the makers. In operation, the rotor is revolved independently until synchronous speed is obtained and then the load is started by exciting the clutch. An important installation of this motor was that made in the plant of the Louisville Cement Co.

The Westinghouse company also mentions the new Westinghouse change-over switch, the new safety fuse box and its WK-21 reversing switch and the motor operated mechanism for disconnecting switch as improvements that will find application in the rock products field.

Allis-Chalmers announces it has recently placed on the market a complete line of 60-cycle and 25-cycle squirrel cage and slip ring induction motors equipped with Timkin tapered roller bearings, which will withstand heavy radial and thrust loads. The lubrication is simplified as only grease is used and frequent attention is not required.

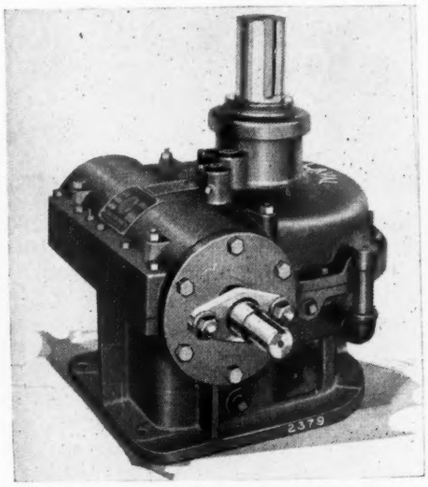
In the way of transmission machinery,



Two new circuit breakers

the increasing use of speed reducers has already been mentioned. A novel form that will have application in certain places is introduced by the De Laval Steam Turbine Co. It is of the worm type and has an upright vertical shaft on the low speed side. Both worm and gear are so arranged that they dip into the oil well, assuring copious lubrication. The same company also makes a single helical gear for ratios from 2 to 1 up to 5 to 1, either speeding up or speeding down.

Foote Bros. Gear and Machine Co. have brought out a number of new reducers during 1925. Some of these are: A vertical worm gear speed reducer, a double worm gear reduction unit, a right angle drive spur gear reducer and a complete



New speed reducer with vertical shaft on the low speed side

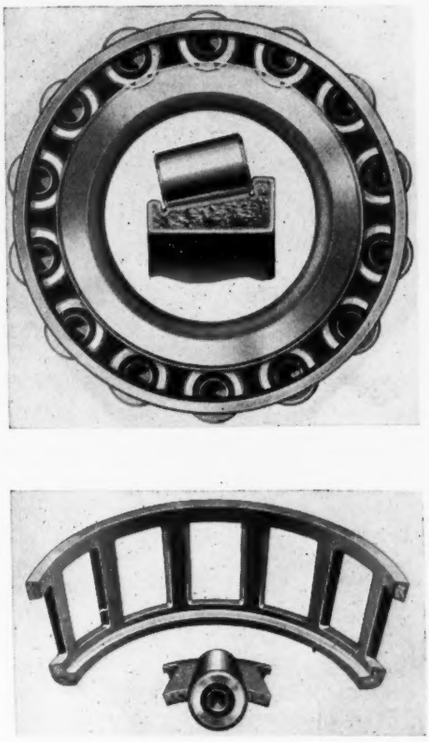
line of herringbone gear speed reducers.

The Hill Clutch Machine and Foundry Co., which brought out its "industrial type" speed reducer two years ago, has added a flexible coupling this year. This

company is manufacturing a new device called the "Steelarm" automatic belt tightener. This has an idler pulley that automatically follows up the slack and wraps the belt farther around the slipping pulley.

Of belt drives, a most unusual type has been introduced by the Allis-Chalmers Manufacturing Co. It is called the "Texrope" drive and it was fully described in Rock Products for November 14.

The Poole Engineering and Machine Co. has developed a new type of flexible



Details of new roller bearing

coupling which it is said will have application in the rock products field. It was placed on the market in December.

Roller bearings are so coming in favor that the very complete catalog issued by the Hyatt Roller Bearing Co. will be appreciated by those who intend to use such bearings and who wish to find the capacity and the uses of the various forms of bearings.

A new design of anti-friction roller bearing has recently been brought out by the Timken Roller Bearing Co. The makers describe the changes from the older form as follows:

"The design of the roll has been changed so that the surface of the large end presents a right angle relation to the center line of the roll. The contact then between the large end of the roll and the rib of the cone is in two areas, the rib of the cone being slightly undercut. This two-area contact insures perfect axial alignment between the center line of the roll and the center line of the bearing at all times. Likewise there is always absolute line contact between the surface of the roll and the surface of the cone, and between the surface of roll and the surface of the cup.

"Although the Timken bearing in use for a number of years showed a remarkably low coefficient of friction, yet the improved type has reduced this materially. The self-aligning properties of the rolls to the cone face admit much higher running speeds. The nickel molybdenum alloy steel, of special Timken formula reduces wear, so that in most cases the initial adjustment need never be disturbed."

Among the power accessories, one which will interest users of internal combustion engines, is the "protectometer" of the Staynew Filter Corp. Its purpose is to keep dust, dirt and the like from entering the cylinders of engines and air compressors. It was described in detail in Rock Products for June 13.

Waste heat boiler installations are being made in old and new cement plants. The George T. Ladd Co. made a very large installation in the new Peerless plant consisting of three 1000 hp. boilers (one for each kiln) using waste heat and a 500 hp. boiler fired by pulverized coal. Steam is generated in these boilers at 200 lb. pressure and 100 deg. superheat.

The Edge Moor Iron Co., makers of the Edge Moor single pass boiler, writes that it has new installations under way and notes that a number of cement plants which have no waste heat boilers at present intend to make such installation shortly.

Crushers and Pulverizers

DESIGNERS and inventors have not produced much that is new in the crushing and pulverizing field.

The improvements reported have been mostly in details of design and construction of standard machines. Some unusually large crushers have been made. The Allis-Chalmers Manufacturing Co. built a number of 60-in. gyratories for export, said to be the heaviest gyratory crushers ever built. The weight of one was nearly 1,000,000 lb.

This company has added an 18-in. size to its line of McCully fine reduction crushers, hitherto built only in 6-in. and 10-in. sizes.

This company's compeb mill has been steadily improved during the year and the combination division head, which has up to this time been adapted to wet grinding only has been changed to adapt it to dry grinding. The passage from the compartment in which the preliminary grinding is done to the next compartment is by sweeping a current of air through the mill. By the use of an air current and a dust collector the finish compartment may be discharged in the same way, thus increasing the uniformity and the fineness of the finished product.

The Western Wheeled Scraper Co. has brought out a new wide jaw crusher in response to the demand for a fine crusher of larger capacity than their regular models. It has an opening 11x36 in. instead of the 11x20-in. opening on the regular machine.

In hammer mills, the Williams Patent Crusher and Pulverizer Co. reports installations of their Mammoth crusher in two Texas cement plants which crush everything from 48-in. down to 1-in. in one operation.

The Dixie Machinery Manufacturing Co. has put a new hammer mill crusher on the market known as the "Mogul," which has a patented device to adapt it to muddy feed. It was described in the September 5 issue.

The Jeffery Manufacturing Co. brought out a rigid hammer crusher for crushing coal, especially as a preliminary to coal pulverizing. It was described in the May 30 issue.

Among the advances in pulverizers is noted the "pyrator" of the F. L. Smidth and Co., a machine which dries, granulates and pulverizes coal for cement burning and similar purposes. This concern has also brought out a new, large-sized kominuter. Details of these machines will be published in a short time.

The Jackson and Church Co., who are makers of sand-lime brick machinery, have introduced a new rod mill, 3 ft. diameter and 10 in. long. This, while it is a grinder, is primarily adapted to the mixing of lime and sand for brick making.

The Raymond Bros. Impact Pulverizer Co. have made an unusual installation of their "Imp" pulverizers at the plant of the U. S. Gypsum Co. at Oakfield, N. Y. This machine pulverizes the coal to the size required for burning and delivers it directly to the burner of a rotary calciner.

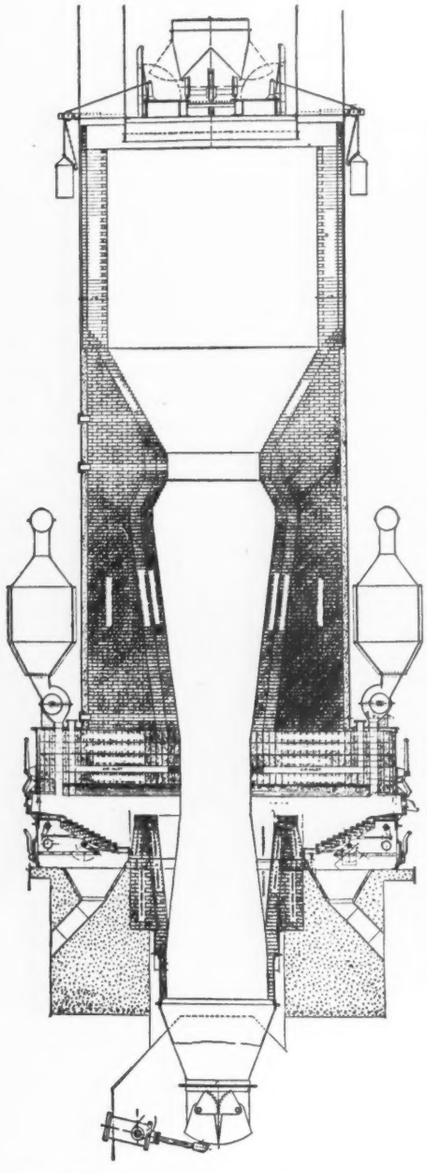
Lime Kilns and Hydrators

ADVANCE in lime kiln design and construction has been very marked in 1925. Some of this is not ready for publication, but descriptions of forms of kilns which are being built at the present time and which will exemplify some of this advance will appear in Rock Products in the early issues of the coming year.

However, there is one new kiln which has already proved itself during the year. This is the Schaffer kiln, designed by the Schaffer Engineering Co. and installed in the Champlain Valley Lime Co.'s plant at Winooski, Vt. It is described more in

detail in the pages of this issue devoted to the progress of the lime industry during 1925. A similar installation is being made by the New England Lime and Cement Co. at Rockland, Me.

As explained elsewhere, some of the new features of this kiln are its great height, which gives it a large preheating section in addition to the fireless calcining section and an ample cooling section, the peculiar interior shape and the manner in which it is fired. The specially designed stokers are described and explained in the article referred to. The design and interior construction are shown in the accompanying line cut, and the makers claim that this interior design makes it "the most successful slip kiln yet made, the lime moving evenly throughout the kiln whenever the draw shears are opened."



Vertical section through the new lime kiln described

Operating records are not yet available for publication, but the makers of the kiln say of the production and capacity:

"A carefully conducted check on these kilns over a period of 11 days showed an average daily capacity on high calcium lime of 41 tons. They showed a fuel ratio on this same test of 6 lb. of lime to 1 lb. of coal having a fuel value of 13,000 B.t.u.'s. The average core did not exceed 400 lb. a day."

The quality of the lime appears to be excellent and even better than that which was produced in the old kilns using wood as fuel.

The stone charged is from the company's quarry and ranges in size from ½-in. to 8-in. and 10-in.

Rotary lime kilns have not lost favor during the year and some remarkable installations have been made. But these are so well covered in the article on the progress of the lime industry in this issue that it would be only repetition to describe them here.

No marked changes in lime hydrators was noted during the year. The Schulthess hydrator, which was introduced in 1924, was installed in 10 plants during 1925. A typical installation was that made recently by the Pierce City Lime Co. of Pierce City, Mo., a description of which is expected to appear in Rock Products in 1926. This hydrator is made by the McGann Manufacturing Co.

The Kritzer Co. has made a number of installations of the Kritzer hydrator durin the year. One that is unusual in American lime practice is at the plant of the Amsden Lime Co. at Amsden, Vt. The material hydrated is called a "hydraulic cement," although it would seem to be more properly described as a hydraulic lime. The calcium content is said to be 42% and it contains considerable quantities of silica, alumina and iron.

Miscellaneous Equipment

THE outstanding development in packing machinery and devices is the Bates multiwall bag. This is made with five walls of tough, pliable paper which is sewed at the top and bottom with a bound seam. The paper is waterproofed so that moisture cannot enter, and this is of great importance in sacking cement as it prevents premature setting so often appearing as "warehouse setting." Ordinary rains will not affect a shipment in these sacks, according to the makers, even though the sacks lie out in them unprotected.

The sack has the Bates valve at one corner and is filled in the ordinary way from Bates valve bag machines.

The makers, the Bates Valve Bag Co., claim that this is a thoroughly successful non-returnable paper bag, and the claim would seem to be borne out by experience. It should be welcome to the cement industry, for the handling of sacks and cleaning and repairing of them takes a large amount of labor and supervision to say nothing of the accounting that is necessary to keep run of the sacks and their return.

Another package which is of particular interest to the rock products industry is the steel shell made by the Pittsburgh Steel Drum Co. The makers write that they have recently developed a type which is especially adapted to the shipment of lime. One advantage of this type of package is the saving of freight as the drums are shipped into the plant.

An accessory of particular interest to the quarry industry is the Nordberg machine for shifting railroad tracks which was described in the issue of Rock Products dated July 11. This has recently been put on the market in a larger size.

Welding devices have made some advance in the year. Among the devices introduced was a portable generator made by the Oxweld Acetylene Co. It was described in the November 12 issue of Rock Products.

Wire rope is a prdouct which has been made with very little variation for years, but this year a new kind was brought out by the American Cable Co. It is called the "Tru-lay" rope and the makers say that "each wire or strand is 'preformed' to the exact shape it must take in the completed rope, thereby avoiding the dangers of high-stranding, kinking, unbalanced load on strands, unstranding and wear in bending stresses." Another advantage is that the use of the Lang lay is made practical. Rope users have long known that Lang lay has many advantages over regular lay for certain sheave and drum work. In Europe 80% of all mine cable is Lang lay but in the United States it has been used very little because of the difficulties that have been met in splicing and handling it. Tru-lay overcomes those difficulties and permits the rope unseized to retain its shape perfectly."

The Broderick and Bascom Rope Co., makers of "yellowstrand" rope have moved into their nwe million-dollar wire-rope factory in St. Louis. In mentining unusual installations of the year the company wrote:

"The biggest of all Broderick and Bascomb's giant closing machines has just been moved to the new plant, having been on special duty turning out 9200 ft., 1¾-in. yellow strand rope, weighing 50,090 lb. The reel on which it was shipped was 8½ ft. high and weighed 3180 lb. The cable was made to order for use on a precipitous mountain incline. This is the longest and heaviest cable ever made for incline purposes. This machine is capable of laying up wire rope 4 in. in diameter, weighing 70 tons, or 140,000 lb."

Rolled Manganese Steel

Rolled manganese steel was first produced in a commercial way a few years before the war and found favor at once among producers in the rock products industry as well as in the mining field and coke plants.

From a small list of articles consisting chiefly of flat link chain, forged chain pins, bushings, woven rod screnes and chute plates, it has grown to include hundreds of other products and in fact practically any article which can be produced from ordinary carbon steel.

At the beginning of the war the United States Government, after exhaustive research with many metals, adopted rolled manganese steel for trench helmets, being the strongest and toughest steel for its weight known. The entire output of rolled manganese steel was thus turned into army trench helmets.

After the war the industry went ahead on a newly organized basis and great progress has been made in the methods of fabrication and even greater steps in the application of rolled manganese steel to industry particularly rock products and its allied fields.

Process of Manufacture

Originally, rolled manganese steel, like any other steel, is a casting; in this case in the form of a 19-in. diameter ingot weighing two tons. This large ingot then passes through immense blooming rolls, squeezing and reducing it in size. Each time it thus passes through the rolls the steel is hot worked, thus refining and purifying the metal, and many passes are necessary to reduce this large ingot down to comparatively small slabs a few inches thick, or billets a few inches square. This billet, in turn, is heated and passed through formed rolls back and forth until it comes out in a round bar to be used for pins; a flat bar to be used perhaps in side links of a river dredge chain or tapered bars for a grizzly. The slabs in the same way pass back and forth until they are reduced from their 2- or 3-in. thickness down to thin gauges as light as No. 19.

The constant rolling, forging and working of the original cast manganese steel produces qualities of great strength running on the average from 150,000 to 160,000 lb. per sq. in., unusual toughness and a close, fine grain structure. To receive the full benefit of the inherent qualities of rolled and forged manganese steel a proper and scientific heat treatment differing even from that of cast manganese steel must be given it.

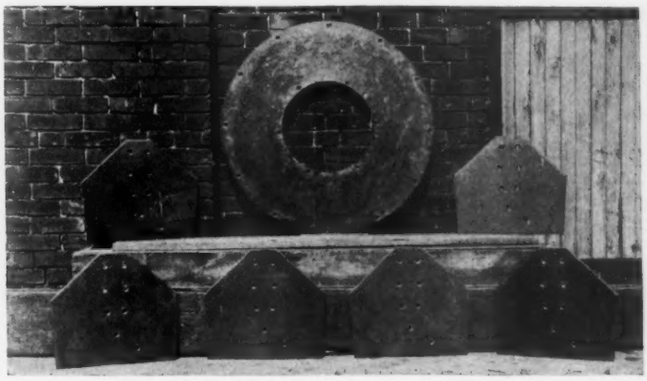
On account of rolled manganese steel's great strength, combined with its abrasive resistance, it is being widely adapted for chain pins, bushings, woven wire screens, chute plates, mixer liners, bin liners, dredge pipe, chain, grinding balls, hammers, etc., wherein the constructive weight of necessarily heavy machinery is greatly reduced without sacrifice of wearing qualities.

This is particularly appreciated in the rock products industries which always must fight severe abrasion without hope of adequate lubrication. The fact that improved methods have been found for the forming, bending, forging, punching, countersinking and otherwise preparing articles for commercial use has opened a wide field for its adoption to industry with economy to the producer whose first thought must be keeping the machinery running day and night.

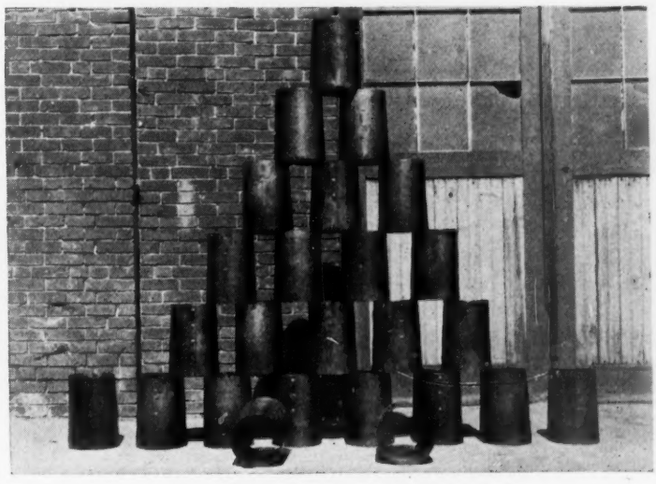
The following products are now made in rolled manganese steel particularly for the rock products and allied industries:

Grinding Balls—Tube, Kominuter, Circular.
Blades—Exhaust Fan, Concrete Mixer.
Mixer Liners—Concrete, Asphalt.
Woven Rod Screens—Flat, Circular, Conical, Flanged.
Chain Pins—Tractor Pin.
Bushings—Conveyor, Chain.
Flights—Conveyor.
Plates—Chute, Bent, Rolled, Punched, etc.
Grizzly Bars—Tapered.
Dredge Pipe—Welded and Riveted.
Gudgeons.
Bolts.
Bucket Lips.
Drag Scraper Lips and Runners.
Fabricated—Sheets, Plates, Bars.
Magnetic Separator Drums.
Tractor Treads.
Hopper and Car Liners.

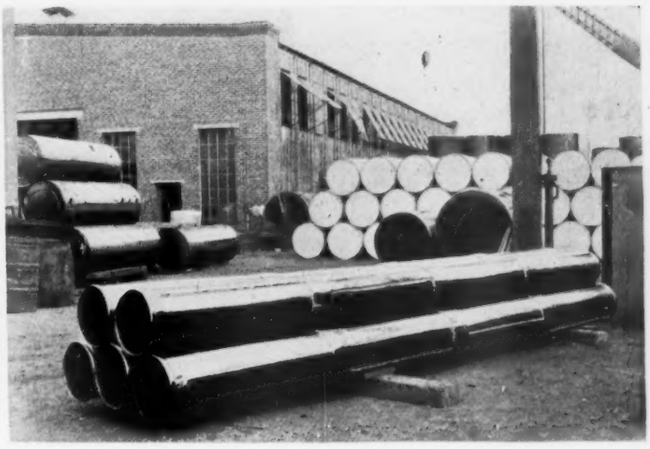
Liner plates for dryers, etc.



Electric magnet face-fan blades



Telescoping, flexible pipe for conveying rock products



Dredge pipe for sand and gravel, of rolled plates

Portland Cement Output in November

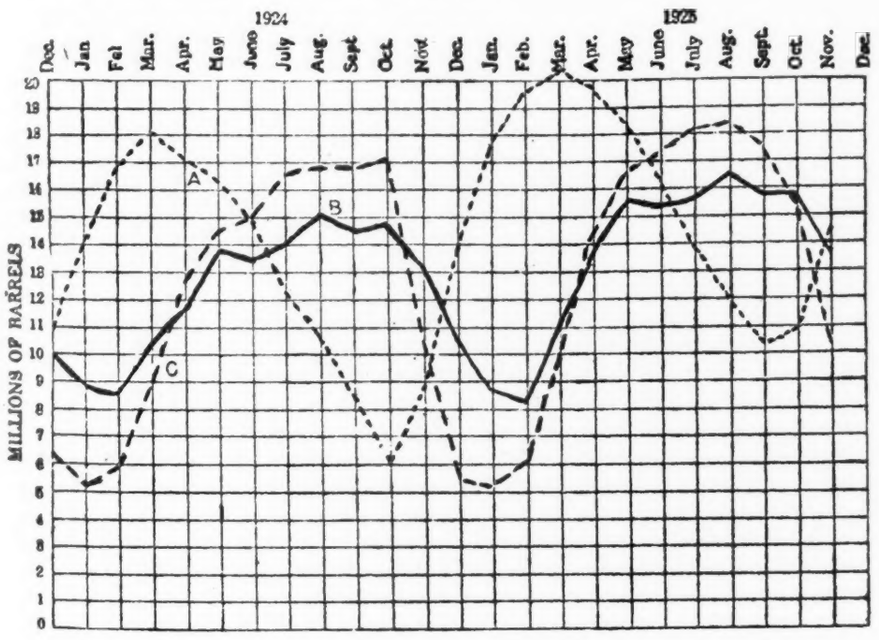
Shipments for Month Total 10,169,000 Barrels

PRODUCTION and shipments of portland cement in November show the expected seasonal decreases, according to statistics compiled by the Bureau of Mines, Department of Commerce. As compared with the corresponding period of 1924 production shows an increase, shipments a slight decrease, while stocks are nearly 62% greater. The following tables prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines are compiled from reports for November, 1925, received direct from all the manufacturing plants except one for which estimates were necessary on account of lack of a return.

Clinker Stocks

Stocks of clinker, or unground cement, at the mills at the end of November, 1925, amounted to about 5,004,000 bbl. compared with 4,086,000 bbl. (revised) at the beginning of the month.

An estimate of the unground clinker by months is given in the last table.



(A) Stocks of portland cement at factories. (B) Production of finished portland cement. (C) Shipment of finished portland cement from factories

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during September and October, 1924 and 1925.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES, IN SEPTEMBER AND OCTOBER, 1924 AND 1925, IN BARRELS*

Shipped	September, 1924	September, 1925	October, 1924	October, 1925
Alabama	167,959	192,882	197,661	158,310
Alaska	1,846	455	437	528
Arizona	39,176	34,380	44,385	33,577
Arkansas	114,134	54,377	119,926	52,339
California	936,834	1,120,092	983,747	1,125,094
Colorado	150,865	122,128	164,675	103,024
Connecticut	193,380	232,265	182,135	230,906
Delaware	52,272	63,024	47,713	63,752
District of Columbia	79,399	84,260	78,597	94,295
Florida	220,021	522,465	184,982	535,817
Georgia	151,930	134,340	137,133	134,198
Hawaii	2,076	3,511	2,736	8,086
Idaho	30,221	24,959	29,721	21,228
Illinois	1,584,579	1,658,700	1,586,058	1,256,952
Indiana	764,188	625,962	653,557	476,635
Iowa	461,405	368,763	401,177	259,971
Kansas	228,064	205,607	288,005	215,258
Kentucky	222,361	196,628	253,180	139,790
Louisiana	116,770	80,907	112,263	77,948
Maine	41,945	40,051	42,897	40,243
Maryland	230,946	260,019	243,639	196,739
Massachusetts	364,320	326,615	385,297	349,702
Michigan	1,263,113	1,195,566	1,217,809	992,423
Minnesota	397,268	455,011	335,139	375,975
Mississippi	59,499	56,979	59,230	41,777
Missouri	501,596	597,568	593,899	505,730
Montana	24,935	24,598	19,682	19,205
Nebraska	204,610	206,703	226,786	193,568
Nevada	12,815	10,598	10,010	10,048
New Hampshire	37,872	48,675	42,073	52,975
New Jersey	756,579	809,251	774,400	847,301
New Mexico	29,306	12,945	13,848	17,048
New York	1,953,647	2,006,604	1,971,186	1,880,822
North Carolina	295,252	354,835	326,870	328,705
North Dakota	24,990	33,458	15,796	28,020
Ohio	1,059,982	1,118,150	1,255,408	870,645
Oklahoma	185,550	195,542	207,750	212,696
Oregon	141,492	157,333	112,073	155,066
Pennsylvania	1,672,054	1,937,173	1,813,998	1,490,931
Porto Rico	0	346	1,000	0
Rhode Island	70,196	71,846	80,138	84,229
South Carolina	52,416	82,742	42,076	69,548
South Dakota	60,159	56,838	67,413	41,532
Tennessee	196,000	171,080	187,410	118,768
Texas	308,305	328,962	357,878	290,696
Utah	47,993	44,564	39,420	40,238
Vermont	36,842	28,794	30,376	31,509
Virginia	184,713	184,071	178,013	156,782
Washington	175,169	258,182	154,515	254,164
West Virginia	191,320	201,698	187,214	193,757
Wisconsin	603,204	513,479	556,838	285,712
Wyoming	38,828	20,461	32,900	16,522
Unspecified	37,101	74,427	45,338	36,326
	16,777,497	17,610,869	17,096,407	15,217,110
Foreign countries	49,503	100,131	63,593	91,890
Total shipped from cement plants	16,827,000	17,711,000	17,160,000	15,309,000

*Includes estimated distribution of shipments from three plants in September, 1925, and in October, 1924 and 1925, and from four plants in September, 1924.

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII, AND PORTO RICO IN OCTOBER, 1925*

	Barrels	Value
Alaska	971	$ 3,227
Hawaii	3,376	8,274
Porto Rico	6,415	14,230
	10,762	$25,731

*Compiled from records of the Bureau of Foreign and Domestic Commerce and subject to revision. †Imports and exports in November, 1925, not available.

IMPORTS AND EXPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1924 AND 1925

	Imports				Exports			
	1924		1925		1924		1925	
Month	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	153,839	$250,799	229,838	$361,098	88,586	$252,497	71,596	$207,547
February	162,930	219,588	119,077	206,308	62,606	194,110	56,249	181,356
March	160,517	254,745	218,054	374,839	91,224	254,687	65,248	200,410
April	148,137	227,300	197,686	280,826	83,200	229,183	89,508	263,831
May	161,304	232,950	186,897	286,959	88,850	262,290	85,385	250,845
June	196,655	283,112	254,937	409,539	74,064	229,852	71,343	217,899
July	108,944	181,111	335,118	499,602	60,139	186,073	98,141	286,543
August	192,634	305,690	380,568	611,551	85,883	251,904	103,961	289,904
September	138,369	232,991	513,258	789,152	69,470	206,921	102,649	285,225
October	214,987	337,199	535,092	824,421	79,180	253,479	73,369	228,467
November	198,806	305,598	(†)	(†)	42,490	130,519	(†)	(†)
December	173,814	285,481	.....	.....	52,851	163,639	.....	.....
	2,010,936	$3,116,564	.....	.....	878,543	$2,615,154	.....	.....

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN NOVEMBER, 1924 AND 1925, AND STOCKS IN OCTOBER, 1925, IN BARRELS

Commercial district	Production. November, 1924	Production. November, 1925	Shipments. November, 1924	Shipments. November, 1925	Stocks at end of November, 1924	Stocks at end of November, 1925	Stocks at end of October, 1925*
E'n Penn., N. J. & Md.	3,376,000	3,457,000	2,845,000	2,909,000	1,211,000	1,350,000	802,000
New York	655,000	872,000	523,000	609,000	511,000	674,000	411,000
Ohio, W'n Penn. & W. Va.	1,277,000	1,241,000	932,000	852,000	817,000	1,904,000	1,515,000
Michigan	928,000	988,000	581,000	585,000	629,000	1,218,000	815,000
Wis.,† Ill., Ind. & Ky.	1,894,000	1,941,000	1,278,000	1,212,000	1,048,000	2,882,000	2,153,000
Va., Tenn., Ala. & Ga.	1,095,000	1,178,000	1,070,000	754,000	314,000	708,000	283,000
E'n Mo., Ia., Minn. & S. Dak.‡	1,313,000	1,220,000	782,000	769,000	2,034,000	2,422,000	1,970,000
W'n Mo., Neb., Kans. & Okla.	943,000	859,000	737,000	818,000	1,078,000	1,559,000	1,518,000
Texas	384,000	396,000	358,000	337,000	242,000	441,000	382,000
Colo. & Utah	194,000	65,000	134,000	113,000	241,000	349,000	398,000
California	887,000	1,099,000	890,000	1,029,000	364,000	527,000	458,000
Ore., Wash. & Mont.	195,000	323,000	159,000	182,000	439,000	416,000	274,000
	13,141,000	13,639,000	10,289,000	10,169,000	8,928,000	14,450,000	10,979,000

*Revised. †Began producing June, 1924. ‡Began producing December, 1924, and shipping January, 1925.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1924 AND 1925, IN BARRELS

Month	Production 1924	Production 1925	Shipments 1924	Shipments 1925	Stocks at end of month 1924	Stocks at end of month 1925
January	8,788,000	8,856,000	5,210,000	5,162,000	14,155,000	17,656,000
February	8,588,000	8,255,000	5,933,000	6,015,000	16,815,000	19,689,000
March	10,370,000	11,034,000	8,995,000	10,279,000	18,189,000	20,469,000
First quarter	27,746,000	28,145,000	20,138,000	21,456,000	.....	.....
April	11,726,000	13,807,000	12,771,000	14,394,000	17,159,000	19,877,000
May	13,777,000	15,503,000	14,551,000	16,735,000	16,403,000	18,440,000
June	13,538,000	15,387,000	15,036,000	17,501,000	14,903,000	16,409,000
Second quarter	39,041,000	44,697,000	42,358,000	48,630,000	.....	.....
July	14,029,000	15,641,000	16,614,000	18,131,000	12,319,000	13,896,000
August	15,128,000	16,419,000	16,855,000	18,383,000	10,666,000	11,952,000
September	14,519,000	15,939,000	16,827,000	17,711,000	8,404,000	10,247,000
Third quarter	43,676,000	47,999,000	50,296,000	54,225,000	.....	.....
October	14,820,000	15,992,000	17,160,000	15,309,000	6,073,000	*10,979,000
November	13,141,000	13,639,000	10,289,000	10,169,000	8,928,000	14,450,000
December	10,435,000	.....	5,506,000	.....	13,913,000	.....
Fourth quarter	38,396,000	.....	32,955,000	.....	.....	.....
	148,859,000	.....	145,747,000	.....	.....	.....

*Revised.

IMPORTS AND EXPORTS*
IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES, AND BY DISTRICTS, IN OCTOBER, 1925

Imported from—	District into which imported—	Barrels	Value
Belgium	Massachusetts	19,397	$28,017
	New York	1,191	2,400
	Philadelphia	23,216	34,301
	Florida	60,534	93,069
	Mobile	24,140	48,492
	New Orleans	25,099	39,149
	Los Angeles	16,907	20,893
	San Francisco	9,472	12,197
	Oregon	23,532	39,063
	Washington	2,002	2,892
	Hawaii	35,745	47 117
	Total	241,235	$367,590
Canada	Maine and New Hampshire	95	$285
	Vermont	5,386	7,713
	Saint Lawrence	137,361	214,397
	Buffalo	8,710	13,360
	Florida	46,563	65,543
	Oregon	137	351
	Total	198,252	$301,649
Cuba	Florida	43	$153
Denmark	Porto Rico	41,976	$63,578
France	Los Angeles	8,310	$12,175
	San Francisco	256	533
	Washington	274	704
	Total	8,840	$13,412
Japan	San Francisco	.....	$10
	Hawaii	250	412
	Total	250	$422
Norway	Maine and New Hampshire	3,003	$4,782
	Massachusetts	34,434	61,915
	Florida	6,708	10,065
	Total	44,145	$76,762
United Kingdom	Washington	351	$855
	Grand total	535,092	$824,421

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES, IN OCTOBER, 1925

Exported to—	Barrels	Value
Canada	1,326	$ 6,653
Cuba	27,893	64,633
Other West Indies	5,887	13,014
Mexico	8,388	24,150
Central America	3,146	9,739
South America	23,836	92,315
Other countries	2,893	17,963
	73,369	$228,467

ESTIMATED CLINKER (UNGROUND CEMENT) AT THE MILLS AT END OF EACH MONTH, 1924 AND 1925, IN BARRELS

Month	1924	1925
January	5,458,000	7,017,000
February	6,905,000	8,497,000
March	8,271,000	9,962,000
April	8,545,000	9,731,000
May	8,225,000	9,053,000
June	7,609,000	7,937,000
July	6,646,000	6,961,000
August	5,367,000	5,640,000
September	4,260,000	4,561,000
October	3,548,000	*4,086,000
November	4,025,000	5,004,000
December	5,433,000	.....

Lehigh to Build Florida Plant

THE Lehigh Portland Cement Co., of Allentown, Penn., will shortly build a cement plant in Florida, according to an announcement made public by the officials of the company recently. During the past few months, the Lehigh company has acquired approximately 1,275 acres of land in the heart of the limestone region of Florida in the vicinity of Ocala. Development on an extensive scale will begin at once. The Ocala plant will be the twenty-first link in the chain of Lehigh mills stretching from coast to coast. The output of the Florida mill will materially increase the production of the company, which now, with a capacity of over 23,000,000 bbl. is the largest manufacturer of portland cement in the world.

For some years, the Lehigh company has been one of the largest shippers of cement into Florida, and this year has made heavy shipments by steamer from New York to Florida ports to supplement rail shipments from its Birmingham plant and to overcome the railroad congestion at the Jacksonville gateway. It has been this acute freight situation as much as the increasing demand for cement which has convinced the officers that a Florida plant is not only an advantageous but a necessary adjunct.

One of the vice-presidents of the company, when interviewed, stated: "Our plans for a mill in Florida have been under consideration for some time, and we have made complete and thorough surveys of a number of properties within the state. We have finally decided on the Ocala property because we are confident that, from the limestone in this locality, we can manufacture a cement equal in quality to the standard set by our other mills. Purchase of the property, however, has been hastened by the freight congestion which has made it increasingly difficult to ship building materials from outside.

"The fact that Florida produces no natural fuels of its own was for a long time a deterrent factor, but the desire to insure a local source of supply for our Florida customers has finally outweighed this and other minor objections. We are extremely anxious to push the work as rapidly as possible, so that we may begin shipping cement in the early fall."—*The Dixie Manufacturer.*

W. H. Carey

CEMENT PRODUCTS manufacturers throughout the country will be grieved to learn of the recent death of W. H. Carey, president of the National Concrete Products Association and for two years president of the Wisconsin Concrete Products Association.

W. H. Carey

Mr. Carey not only was active as a manufacturer in Wisconsin, but possessed the ability to imbue other members of the association with the possibilities and vision of the cement products business. The high regard his associates bore him is best witnessed by their electing him to the highest offices.

The industry has lost a friend and executive that will be hard to replace.

Lehigh Cement Acquires Tidewater Cement and Holdings

THE Tidewater Portland Cement Co., Baltimore, Md., including all its real property, trademark title and good will, was sold to the Lehigh Portland Cement Co. for $3,305,000 by Judge Morris A. Soper in United States District Court at Baltimore, Md. The Lehigh company's first bid was $3,127,551. The Alpha Portland Cement Co. submitted a bid of $3,225,000, which the North American Cement Corp. raised to $3,260,000. The Tidewater company failed last July.—*N. J. Journal of Commerce.*

Note: An earlier report published in ROCK PRODUCTS October 17 issue on the authority of several financial institutions stated that the successful bidder for the properties was the North American Cement Corp., but this bid was not ratified by the court.

Ohio Company Plans Extensive Crushed Stone Operation

THE Ohio Hydrate and Supply Co., Woodville, Ohio, is making extensive additions at their plant preparatory to increasing their crushed stone operations. Up to the present time the stone business has constituted a very small part of the company's business, lime being the chief product.

A 60x84-in. Traylor jaw crusher is being installed on the level of the quarry floor. The sizing of the kiln stone will be done in the quarry and the spalls carried over a 30-in. belt conveyor, erected over an 18-in. incline to the crushed stone plant, which is equipped with 10 bins and shaker screens so as to make 10 commercial sizes. Robins Cataract grizzlies and shaker screens are used. The capacity of the plant is estimated at 5000 tons per day. The standard gage steel cars for use in the quarry have all been delivered as well as a Model 92 Marion electric caterpillar type shovel equipped with a 3½-yd. bucket.

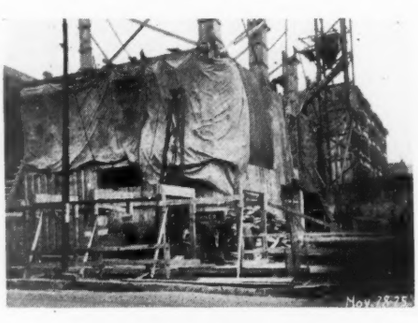
Most of the structural steel work at the plant has been completed and operation on the increased scale expected to begin about February, 1926. The entire work was planned by the company's own force, and it is said that the installations are a departure from plants erected heretofore.

Portland Cement Association Home Progresses

WORK is progressing steadily on the new Portland Cement Association building at Grand and Dearborn streets, Chicago. Weather conditions have not been allowed to interrupt the progress of the work.

On this all-concrete structure the practices which have been established as standard for winter-time construction are being followed with the painstaking care of an instructor proving his own contentions.

As shown in the accompanying illustration, methods are used which demonstrate the practicability of getting uniformly high strength, quality concrete regardless of the weather.



Portland Cement Association builds in winter

A. J. Sullivan in Mexico

FRIENDS of A. J. Sullivan, former vice-president and general manager of United States Crushed Stone Co., Chicago, and later of the Inland Crushed Stone Co., Chicago, have recently received word from him in Mexico City, where he is an official of the

A. J. Sullivan

Byrne Bros. Construction Co., contractors for extensive highway construction projects. Mr. Sullivan has charge of procuring much of the materials to be used and is building several quarry and gravel plants. He was for several years treasurer of the National Crushed Stone Association and has many friends in the quarry industry.

Rock Asphalt Corporation of Alabama Starts Operation

THE Rock Asphalt Corporation, Cherokee, Ala., is about ready to start operations of their plant. For the past two years they have been busy developing the properties acquired from the Cherokee Rock Asphalt Co. A new mill has been built, railroad connections constructed, and the quarries developed. The deposit of rock said to be present in large quantity consist of silica bitumen and a small percentage of limestone, which requires only grinding to make excellent paving material. New machinery for the plant was purchased from the Allis-Chalmers Manufacturing Co., Milwaukee, Wis. In the next year the company expects to produce about 500,000 tons of ground rock asphalt. A. R. Runyon is president of the company.

Aggregate in Good Demand in Chicago District

RETAILERS are drawing heavily on their storage piles of sand, gravel and crushed stone. In all parts of the city concrete work is being rushed. Indications now are that, barring heavy snow and extreme cold, December will establish a new record in this market for the mixing of concrete.

Demand is running ahead of December a year ago, and as yet dealers have experienced but little difficulty resulting from the handling of frozen aggregates.

Complaint still was heard concerning low prices. This was due more or less to keen competition. The season of torpedo sand and gravel production is about over and the pits are closing for the winter months.

It was reported that the dealers anticipating a season of more active winter building are well stocked on aggregates. In many instances, however, the tendency is to go along with stocks of cement, plaster, lime, brick and the other materials easier to replenish, kept as low as possible until after inventory. This portends an active early 1926 demand for all those items. A continuation of open weather will result in the completion of a large volume of foundation and other work and these jobs will be ready for deliveries on inside materials in time to take up any possible slackening in the demand for the aggregates.—*Chicago Journal of Commerce.*

Portland Cement Association Promotes J. R. Fairman

J. R. FAIRMAN, district engineer in charge of the Birmingham office of the Portland Cement Association, has been appointed assistant general manager in charge of Southeastern territory, with headquarters in Atlanta, Ga.

The appointment was made at the annual meeting of the Portland Cement Association, held in Chicago recently. He succeeds W. B. Elcock, who resigned to become connected with the new Ocala Portland Cement Co.

Mr. Fairman joined the Portland Cement Association in 1921 and served as field engineer in western Missouri. In July, 1923, he opened the Birmingham office of the association and since that time has been in charge as district engineer.

As assistant general manager in charge of the Southeast, Mr. Fairman will have supervision over district offices in Charlotte, Atlanta, Jacksonville, Nashville, New Orleans and Birmingham.

The states included in his territory are: Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina and Tennessee.

During his stay in Birmingham Mr. Fairman took an active part in the civic activities of the city and was a member of the Chamber of Commerce and many clubs.

Ohio Company to Build New Dredge

THE East End Sand and Gravel Co., Chillicothe, Ohio, has announced the building of a dredge 36x18 ft. on which will be installed an 8-in. suction pump. By this means the company will increase its production to about 1000 tons of sand and gravel per day whereas in the method used, removal by clam-shell buckets, they could only produce from 300 to 400 tons. The plans call for the installation of 150-h.p. motor for general operation and perhaps another 50-h.p. motor to operate the dredge.

Dredging will probably be carried on all along the Scioto river. This river is navigable but is open to dredging so long as there is no interference with the federal government's use of the river. Riparian rights along this stream extend to low water mark of the river and adjoining land owners do not own to the center of the stream, so that if such an installation is entered upon in the matter of sand and gravel withdrawal from the river, it may be developed into a rather large enterprise so long as the market for the product is not too far removed from the scene of operation.

The local company believes, however, that by this new installation they will not only be able to handle a larger volume of product but they will be able to grade it better and handle to a much greater advantage.—*Chillicothe (Ohio) Gazette.*

Michigan Purchase of Cement Plant Recommended

PURCHASE of the state operated cement plant at Chelsea, Mich., was recommended in a report submitted recently to the state administrative board by Henry Croll, Jr., budget director.

According to Croll's tabulations the plant has shown a profit of $283,924 in 18 months of operation. Two fires deprived the state of a prospective $72,000 additional profit, according to the report. It is controlled by the state under an option, with the privilege of buying and applying the annual rental on the purchase price. The option price is $500,000 and the annual rental is $75,000.—*Flint (Mich.) Journal.*

Name Judges for Good Roads Essay Contest

ANNOUNCEMENT has been made of the committee on judges named to select the prize-winning essays in the contest being conducted in the colleges and universities by the American Road Builders' Association in connection with "Good Roads Week," January 11 to 15, 1926. These dates coincide with the American Road Builders' Convention and Road Show to be held in Chicago. The judges selected are:

Thomas H. MacDonald, chief, United States Bureau of Public Roads, Washington, D. C.; William H. Connell, president, American Road Builders' Association, Harrisburg, Penn.; C. R. Ege, president, Highway Industries and Exhibitors' Association, Chicago, Ill.; S. S. Steinberg, assistant director, Highway Research Board, National Research Council, Washington, D. C., and Arthur H. Blanchard, professor of highway engineering, Michigan University, Ann Arbor, Mich.

Prizes totaling $550 are being offered for the best essay not exceeding 600 words on the subject "The New Country by Improved Highways." Essays should be sent to the American Road Builders' Association, Congress hotel, Chicago, Ill., and must be received before January 1, 1926. Winners will be announced by radio during "Good Roads Week" and at the convention of the American Road Builders' Association, to be held in Chicago, January 11 to 15, 1926.

Wrigley Plans Large Indiana Quarry Merger

NEGOTIATIONS are under way for a $50,000,000 stone merger, which, if plans now under consideration succeed, will include 75% of the stone quarries of Monroe and Lawrence counties, Ind., under one ownership and management. Chicago capitalists negotiating the proposed merger are William Wrigley and Lawrence Whiting. At the present time conferences are being held with the owners of the largest quarries of the Bloomington-Bedford district.—*Chicago Journal of Commerce.*

Note: Mr. Wrigley is also interested in a crushed stone plant at Catalina Islands, and at Kankakee, Ill.

United States Gypsum Company to Build Lime Plant in Connecticut

THE United States Gypsum Co., Chicago, Ill., has acquired about 75 acres at North Canaan, Conn., comprising extensive lime deposits, and contemplates the construction of a new plant to cost more than $150,000 with machinery. The United States Gypsum Co. now operates lime plants at Genoa, Ohio, Oakfield, N. Y., York, Penn., and Cordova, Ill., the latter two being high calcium lime operations.

National Soapstone Company and Properties Sold

THE famous old soapstone deposit, plant and equipment of the National Soapstone Co., in Ashe county, western North Carolina, has been sold to Roanoke, Virginia, capitalists, among whom are C. N. Armes, G. C. Nelms, J. A. Jamison. This is one of the largest deposits of soapstones in the country and the plant has been improved and put in condition for operation, so that the new concern is now in position to fill orders which have been accumulating for several months, some of them from foreign countries.—*Greenville (N. C.) News.*

Index to Rock Products, Volume 28

A

Abram, Fred T.: Unique demonstration of the fire resisting properties of concrete tile....Feb. 21 75
Accident prevention:
—— June "no accident" campaign in cement industry....Aug. 8 74
Accidents:
—— Can be prevented. R. N. Van Winkle....Mar. 7 46
—— Prevention and liability insurance..Jan. 24 55
—— Prevention Methods....Dec. 26 130
—— Quarry record in 1924....Nov. 28 46
Advertising:
—— Aggregate, Illinois Sand and Gravel Ass'n. Campaign....July 25 70
—— Sand. Sandy Pratt....Apr. 18 41
—— To sell sand or aggregate, the right kind for sand and aggregates....Jan. 10 43
—— Value in limestone mining....Mar. 21 40
Advocating use of concrete products to save timber....June 13 78
Agee, Alva: What form of lime is best suited for agriculture?....Feb. 7 42
Aggregate:
—— Fine, washing screenings to make. Russell Rarey....Jan. 24 45
—— For concrete pavement. A. T. Goldbeck....Mar. 21 51
—— Industry in Australia....Nov. 28 85
—— Industry in Nebraska and the Dakotas. Edmund Shaw....Sept. 19 40
—— Mineral aggregate industry around Philadelphia. E. Shaw....Apr. 18 66
—— Permanent service bins for....Mar. 7 33
—— Spotted....June 13 79
—— Stronger, by grading....Nov. 28 82
—— Table for computing quantities of cement and aggregate for one cubic yard of concrete. E. Earl Glass....Oct. 17 42
—— Tonnage basis is best for buying and selling sand and gravel. T. H. Walton, Jr....June 27 38
—— Weighing vs. measuring for concrete. E. Earl Glass....Nov. 28 59
Agricultural limestone: Railroads help in promoting the use of....Jan. 10 51
—— New York Central railroad's special train through Michigan and Pennsylvania for education in use of....May 2 66
—— Production, promotion and sale of....Jan. 24 39
—— Review for 1925. J. R. Bent....Dec. 26 120
Alabama Lime and Stone Corporation takes over O'Neal lime works....Feb. 7 61
Albany Crushed Stone Co., Albany, N. Y....Oct. 31 33
Alfred Sand and Gravel Corp., Hornell, N. Y....Sept. 19 39
Alsen plant sold....Mar. 7 78
Alter, Franklin A.: J. L. Shiely's new sand and gravel plant....May 2 33
Alumina cement:
—— Concrete will adhere to portland cement concrete....Feb. 21 63
—— High for 24-hour tests of aggregates....July 25 61
—— Using as a macadam road binder....July 11 49
—— Vs. super portland cements....July 11 48
American Concrete Institute meeting....Mar. 7 55
American Foundrymen's Association convention....Oct. 17 54
American Lime and Stone Co.:
—— Adds large rotary kiln....Oct. 17 80
—— Building new 2000-ton lime-storage tank....July 11 37
—— Plants at Union Furnace, Pa....Dec. 12 35
American Railway Engineers meeting....Mar. 21 34
American Refractories Institute organized....Apr. 18 89
American Road Builders nominations for 1926....Nov. 14 66
American Society for Testing Materials Convention. E. Shaw....June 27 47
Anhydrite:
—— Hydration of. Marie Farnsworth....Nov. 14 42
—— Possibilities for commercial use of. I. Bencovitz....Nov. 14 40
Arabian Crushed Granite Co. plant near Lithonia, Ga....June 27 39
Arrow Sand Co. makes extensive improvements....Oct. 17 34
Art Stone Co. plant at Sioux City, Iowa....Oct. 31 75
Arthur, G. B., appointed technical director of National Lime Association....Aug. 8 72
Asbestos: Production and developments in Quebec asbestos industry. Roy Carmichael....Aug. 8 88
—— Production of and importation in 1924....Sept. 5 60
Ash Grove Lime and Portland Cement Co. lengthens kilns....June 13 72
Associations and Conventions:
—— American Concrete Institute....Mar. 7 55
—— American Foundrymen's Association convention....Oct. 17 54
—— American Railway Engineering Association's annual meeting—Ballast committee report....July 11 59
—— American Road Builders Association nominations for 1926....Nov. 14 66
—— American State Geologists Association at Pennsylvania....Nov. 14 77
—— American Sand Association elects officers....Feb. 7 63
—— A. S. T. M. annual convention. E. Shaw....June 27 47
—— A. S. T. M. annual meeting....July 11 64
—— A. S. T. M. rock products committee meetings....Apr. 4 52
—— Blue Diamond Mortar Producers annual meeting....June 13 46
—— British Portland Cement Association formed....Feb. 21 62
—— Cement experts meet at Bureau of Standards....Oct. 3 50
—— Concrete Products Association 1925 convention....Feb. 7 69
—— Concrete Products Manufacturers plan 1926 convention....Nov. 14 81
—— Florida Lime Rock Association formed....Nov. 28 80
—— Highway Research Board's fourth annual meeting....July 25 82
—— Illinois Crushed Stone Producers reorganize....July 25 66
—— Illinois Sand and Gravel Association meeting....Mar. 21 53
—— Indiana Land and Gravel Association's annual meeting....Dec. 12 56
—— Los Angeles Rock Producers Association formed....Jan. 24 77
—— Missouri Sand and Gravel Producers meeting....June 13 86
—— Missouri Valley Sand and Gravel Producers annual meeting....Dec. 26 158
—— National Crushed Stone 1925 convention....Jan. 24 31
—— National Crushed Stone Association manufacturers' division meeting....Oct. 31 73
—— National Crushed Stone Association midwest division meeting....Oct. 31 73
—— National Crushed Stone Association 1926 convention plans....Oct. 31 73
—— National Crushed Stone Association plans for 1926 convention....Nov. 28 70
—— National Crushed Stone Association accomplishments and objectives....July 11 70
—— National Crushed Stone Association history by N. C. Rockwood....Oct. 17 58
—— National executive committee of the National Sand and Gravel Association and Ohio and Michigan Sand and Gravel Producers Association joint meeting....Aug. 8 64
—— National Lime Association convention program....May 16 49
—— National Lime Association 1925 convention, New York....June 13 33
—— National Lime Association Research activities....Sept. 5 65
—— National Safety Council meeting..Sept. 19 88
—— National Safety Council cement mill section report....Oct. 3 86
—— National Safety Council quarry section report....Oct. 17 43
—— National Sand and Gravel Association's ninth annual convention....Jan. 10 27
—— National Sand and Gravel Association meeting with highway materials experts....June 13 47
—— National Sand and Gravel Association plans for 1926 convention....Nov. 28 71
—— National Slag Association annual meeting....Apr. 18 73
—— New York State Crushed Stone Association meeting....Sept. 19 44
—— New York State Crushed Stone Association meeting....July 11 46
—— New York State Crushed Stone Association meeting....Aug. 22 49
—— Ohio Macadam Association annual meeting....May 2 75
—— Ohio Sand and Gravel Producers joint meeting with N. C. S. A. executive committee....Aug. 8 64
—— Pacific Coast Sand and Gravel Association convention....Nov. 28 58
—— Portland Cement Association lays cornerstone for new home....Nov. 28 72
—— Portland Cement Association's annual meeting....Nov. 28 72
—— Red River Gravel Producers Association first meeting....May 16 84
—— Sand-Lime Brick Association convention....Feb. 7 50
Associations and Conventions (continued)
—— Slate industry conference for 1925..Feb. 7 66
—— Tenth exposition of chemical industries....Oct. 17 48
—— Wisconsin Aggregate Producers annual meeting....Dec. 26 157
—— Wisconsin Concrete Products Association program....Mar. 21 75
Atlas Portland Cement Co. operates gypsum plant in Oklahoma....April 18 65
Atlas Sand and Gravel Co.'s plant....Sept. 5 84
Azbe, Victor J.:
—— A tentative plan for investigating lime kiln refractories....Feb. 21 55
—— Factors governing lime kiln capacity....Mar. 21 41
—— Gas producers in lime plants....May 16 36
—— Theory and practice of lime manufacture:
1. Heat distribution in a theoretical lime kiln—Kiln efficiency rating—Amount of head required....June 27 45
2. Effect of excess air on lime kiln efficiency....July 11 38
3. Incomplete combustion and loss by radiation....July 25 39
4. Judging kiln performance by gas analysis....Aug. 8 39
5. Reduction of kiln efficiency during drawing—Reversed circulation....Aug. 22 52
6. Kiln capacity, rating, proper kiln proportion and some operating data on test kilns....Sept. 19 53
7. Relative merits of kiln firing methods....Oct. 3 59
8. General inefficiency of lime manufacture....Oct. 17 41
—— Volatile matter—its effect on lime kilns efficiency....May 2 60

B

Bacon, R. H.: Diesel engines for rock products plants....Mar. 7 43
Ballast:
—— From crushed quartzite....Mar. 21 49
—— Progress report from joint meeting on....Aug. 8 64
—— Railway, stone for....Jan. 24 52
—— Sand and gravel producers co-operate with railways on specifications for....July 11 59
—— Specifications for....Mar. 21 34
Ballast production: J. L. Shiely's Montana plants....Apr. 18 69
Balthasar, Dr. K.: Magnesia portland cement....May 16 50
Bardwell, R. C.: Possibilities for much greater use of lime in treatment of locomotive boiler water....Nov. 14 60
Baruch, Alfred: Cost finding and its problems in the sand, gravel and quarry industries....Oct. 17 35
Barrows, T. R.: Address to the Pacific Coast Association....Nov. 14 61
Barytes, grinding for pigment (Thomson, Weinman plant)....Mar. 21 37
Basalt Rock Co. aerial tramway system....Aug. 22 65
Basis for haydite rates....Apr. 4 74
Basset, William R.: Cost figures that help you sell....Jan. 10 66
Batchers: Producers installing....June 27 37
Batesville White Lime Co. plant at Arkansas. Tom Shiras....Feb. 7 41
Bauxite: Production in U. S. in 1924..May 30 76
Baylis, J. R.: Use of lime in prevention of corrosion and red water in public water supplies....Sept. 5 59
Beaver Products Co. plant (American Cement Plaster division). C. A. Breskin....Feb. 7 52
Belmont Gurnee Stone Co.'s plant....Dec. 12 41
Bencowitz, I.: Possibilities for the commercial use of anhydrous gypsum..Nov. 14 40
Benedict Stone Co., Chicago, Ill., Lowell new vice-president of....Oct. 17 71
Bennett Gravel Co., Spring Lake, N. J....Sept. 19 33
Bent, J. R.: Agricultural limestone and rock phosphate in grain states....Dec. 26 120
Benton Lime and Stone Co.'s plant....Feb. 21 66
Berger, Ernest E.: Calcium sulphate retarders for portland cement....Oct. 31 56
Bernardsville Concrete Products Co. plant....July 11 73
Berkeley Sand Co.'s plant....May 2 46
Bethlehem Mines Corporation's crushing plants at Steelton, Penn....Mar. 7 36
Bethlehem Steel Corporation helps employes to own homes....Oct. 31 67
Blanc, E. C.: Manufacture of hydraulic lime in France....Nov. 27 47

Blast sand:
—— Making blast sand and other special sands....Feb. 7 36
—— requirements for. W. M. Weigel....Feb. 7 31

Blasting:
—— City officials witness blasting operations of Winchester quarry....Aug. 22 48
—— Utah Copper Co. methods....July 25 50

Blue Diamond:
—— Co.'s new gypsum quarry near Las Vegas, Nev. Kay M. Grier....July 25 47
—— Mortar plant at J. C. Stewart Sand Co. ....June 13 75
—— Mortar producers hold national meeting ....June 13 46
—— Service Corporation, New York City, description of plant....Oct. 3 51
Blue Ridge Talc Co. plant....Aug. 8 62
Bluffton-Lewisburg Stone Co., Bluffton, O., to make extensive additions....Nov. 14 76

Book reviews:
—— Concrete products....Mar. 7 80
—— Florida state limestone report. Oliver Bowles....July 25 33
—— Geologic Structures. Baily Willis....Jan. 10 62
—— Glass manufacture and the glass industry. C. R. Pettke....Jan. 10 62
—— History of the portland cement industry. Dr. Oliver Bowles....Mar. 7 80
—— Igneous Rock Formation....Dec. 26 167
—— Lime and Magnesia by N. V. S. Knibbs. Oliver Bowles....Aug. 8 67
—— Limestone resources of Illinois. Frank Krey and J. E. Lamar of Illinois Geological Survey....Aug. 8 67
—— Lindgren's Mineral Deposits, Second Edition....Jan. 10 62
—— Non-metallic minerals, occurrence, preparation, utilization....May 30 57
—— Report of Vermont's state geologist....Jan. 10 62
Boonville Sand Co. plant....Sept. 19 45
Boston Trap Rock Co.'s plant at Hyde Park, Mass....May 2 43

Bowles, Oliver:
—— Florida state limestone report....July 25 33
—— History of Portland Cement Industry....Mar. 7 80
—— Important problems in the lime industry with special reference to Ohio..July 25 41
—— Lime and Magnesia....Aug. 8 67
—— Non-metallic minerals, etc. R. B. Ladoo ....May 30 57
—— Review of U. S. Bureau of Mines work in 1925....Dec. 26 138
—— Slate in 1925....Dec. 26 142
Boyd, J. R.: New secretary of the N. C. S. A....Oct. 17 57

Brandon Rock Products Corporation's:
—— Stucco and terrazzo plant at Middlebury, Vt....July 11 47
—— Plant at Brandon, Vt....Apr. 4 68
Brazil, Special privileges for new cement plants in....Aug. 8 53

Breskin, Charles A.:
—— Beaver Products Co. plant....Feb. 7 52
—— Egyptian Portland Cement Co. plant....Apr. 4 35
troit....Sept. 5 67
—— Golden Basalt Co. plant....May 30 35
—— Gypsum preparation and manufacture from mine to wallboard....Feb. 7 52
—— Innovations in making sand-lime brick. ....Apr. 18 53
—— Peerless portland cement plant at De-
—— Swing through the West, A....May 2 71

British Columbia:
—— Cement plant to grind Belgian clinker....May 30 62
—— New gypsum plant for....June 27 47
British comments on lime kiln refractories. Alfred A. Searle....May 30 49
British Quarry Association, what the plant has done for the industry. S. McPherson. ....Feb. 7 33

Brooker, Edwin:
—— Traffic and transportation....Jan. 10 70
—— ....Jan. 24 76
—— ....Feb. 7 68
—— ....Feb. 21 70
—— ....Mar. 7 66
—— ....Mar. 21 82
—— ....Apr. 4 74
—— ....Apr. 18 76
—— ....May 2 82
—— ....May 16 82
—— ....May 30 64
—— ....June 13 75
—— ....June 27 66
—— ....July 11 82
—— ....July 25 68
—— ....Aug. 8 78
—— ....Aug. 22 77
—— .... Sept. 5 106
—— ....Oct. 3 70
—— ....Oct. 17 72
—— ....Oct. 31 79
—— ....Nov. 14 78
—— ....Nov. 28 85
—— ....Dec. 26 154

Brown, R. P.: Callow Rock Lime Co.'s plant ....Dec. 12 29
Brown, W. Jess, appointed new southern sales manager of Lehigh P. C.....Sept. 5 108
Bruns hydrated lime plant, Woodville, Ohio.. ....Oct. 3 65
Building industry—Investigation of by builders....Sept. 19 65
Building materials—Modern merchandising methods applied to....Sept. 19 65
Building of moist sand....Feb. 7 80

Bureau of Mines:
—— Investigation of screen sizing....Aug. 8 47
—— New safety service division of....Sept. 5 86
—— Review of work for 1925. Oliver Bowles ....Dec. 26 138
—— Safety work and rock dusting of coal mines....Dec. 12 43
Bureau of Public Roads work. E. Shaw.... ....May 2 68

Bureau of Standards:
—— Investigates weatherproofing gypsum blocks for exterior construction....Feb. 21 74
—— Requirements for concrete brick and tile ....June 13 79
—— Work on lime, gypsum and sand-lime brick....Oct. 31 60
Buckbee, J. C.: Patent for straight line cement plant....Dec. 12 54
Burke, A. P.: Experiences as concrete brick manufacturer....Jan. 10 33

C

"Cal"—A commercially successful lime product....May 16 33
Calcium sulphate retarders for portland cement. Ernest E. Berger....Oct. 31 56
California cement projects....Sept. 5 102
California producers' exhibits at Industrial Exposition at Long Beach....May 30 63
Callahan, M. A., Sand and Gravel Co.'s dredge "W. T. Rossiter"....May 16 45
Callanan Road Improvement Co., South Bethlehem, N. Y....Oct. 31 33

Camp, Henry M.:
—— Filming the lime industry....July 11 33
—— Railroads help in promoting the use of agricultural limestone....Jan. 10 51

Canada Cement Co., Ltd.:
—— Hull, Que., plant. Aeroplane photo.... ....June 27 54
—— Shows good business record. Roy Carmichael....June 27 60
Canada Crushed Stone Co., Ltd., expands.... ....June 13 48

Canadian:
—— Aggregate producers get together for promotional work....June 27 33
—— Gypsum statistics for 1924....June 27 53
—— Mica production in 1924....Sept. 19 45
—— Rock products production in 1924. Gordon C. Keith....May 2 45
Car loadings, chart of sand, gravel and crushed stone from January 1, 1924, to March 21, 1925....April 18 88
—— For 1924 and 1925....Dec. 26 83
Carbon Limestone Co., Hillsville, Penn.... ....Nov. 14 45
Carroll, J. E., Sand Co. plant....Aug. 8 43
Catalytic effect of calcium chloride....May 30 47
Catalysts for reviving dead-burned gypsum.... ....July 11 50
Cebu-Portland Cement Co....June 27 48

Cement:
—— American Society of Testing Materials discusses cement and gypsum....Nov. 14 54
—— Blended....Nov. 28 84
—— British rapid-hardening portland cement ....Aug. 8 63
—— British specification....Nov. 14 44
—— Calcium-sulphate retarders for portland. Ernest E. Berger....Oct. 31 56
—— California cement producers ask higher import duty on cement....Sept. 19 79
—— Clinker—Constitution of....Nov. 14 59
—— Colored, in concrete products....Jan. 10 68
—— Constitution and burning of artificial portland cement, On the. Part 7. J. E. Duchez....Jan. 10 56
—— Constitution and burning of artificial portland cement, On the. Part 8. J. E. Duchez....Apr. 18 45
—— Constitution and burning of artificial portland cement. Part 9. J. E. Duchez....Oct. 3 50
—— Constitution and burning of artificial portland cement. Part. 10. J. E. Duchez....Aug. 8 48
—— Constitution and burning of artificial portland cement. Part XI. J. E. Duchez....Oct. 3 50
—— Effects of gases on cement surfaces.... ....Nov. 14 59
—— Effect of sulphate solutions on constituents of cement....Oct. 3 57
—— German opinions and experiences with super-portland vs. alumina cements.... ....July 11 48
—— German portland cement makers discuss technical progress and American methods at convention at Berlin....May 30 39

Cement (continued)
—— Imports into the United States, analysis of....Nov. 14 70
—— Increase of southern states' cement capacity....Sept. 19 79
—— Increase of imports of cement on Pacific coast....Oct. 17 80
—— Invention may affect raw grind of.... ....June 27 44
—— Kiesel-guhr mixtures, effect of heat on strength of....Nov. 28 51
—— Magnesia, developments in....Dec. 12 61
—— Magnesia-portland cement. Dr. K. Balthasar....May 16 50
—— Manufacturers' Protective Association—Cement anti-trust case ends....Oct. 17 66
—— Montreal makes large shipments to Florida and Europe....Oct. 17 82
—— More new plants for Florida....Aug. 22 74
—— New process for making high alumina cement....May 30 62
—— Portland Cement Association to build own home....Aug. 22 86
—— Prices for first quarter of 1925....Aug. 8 72
—— Problems in cement and concrete research. Dr. C. R. Platzmann....May 2 54
—— Production in December and 1924..Jan. 24 66
—— January, 1925, output....Feb. 21 73
—— February....Mar. 21 70
—— March....Apr. 18 64
—— April....May 16 70
—— May....June 27 51
—— June....July 25 60
—— July....Aug. 22 59
—— August....Sept. 19 80
—— September....Oct. 17 64
—— October....Nov. 28 78
—— November....Dec. 26 191
—— Results of foreign research....July 11 50
—— Retarders. E. E. Berger....Oct. 31 56
—— Review for 1925....Dec. 26 86
—— Security Cement and Lime—Helderberg Cement Co. merger announced..Aug. 22 72
—— Situation in India....Oct. 31 ....
—— Superior enlarges plant....Aug. 22 70
—— Table for computing quantities of cement and aggregate for 1 cu. yd, of concrete. E. Earl Glass....Oct. 17 42
—— Tests show some foreign cements inferior to American product....June 27 49
—— Using high-alumina cement as a macadam road binder....July 11 49
—— With high percentages of alumina..Feb. 7 48
Cement kilns: Coal expense calculation for ....Dec. 12 34
Cement Manufacturers' Protective Association case, full text of the U. S. Supreme Court decision....June 13 61

Cement plants:
—— Canada Cement Co., Ltd., Hull, Que., plant....June 27 54
—— Cebu Portland Cement Co. plant..June 27 43
—— Clinchfield Portland Cement Corporation ....Sept. 19 66
—— Colorado Cement Co. improvements.... ....Sept. 5 66
—— Developments and complications in the building of Lewison P. C. plant.... ....Sept. 5 102
—— European....Nov. 14 55
—— Gilmore Portland Cement Co. plant sold ....Nov. 14 73
—— Kansas Portland Cement Co.'s plant.... ....June 13 49
—— Marquette Cement Co.'s plant at Cape Girardeau, Mo. (Airplane view).... ....Dec. 12 52
—— New Egyptian Portland Cement Co.'s plant. Charles A. Breskin....Apr. 4 35
—— Olympic Porland Cement Co. to increase capacity....Nov. 14 73
—— Peerless Cement Portland Co. plant C. A. Breskin....Sept. 5 67
—— South Dakota state plant a losing proposition....Nov. 28 77
—— Southwestern Portland Cement plant. Geo. M. Earnshaw....Sept. 19 55
—— Standard Portland Cement Co. plant. G. M. Earnshaw....Aug. 22 54
—— Trinity Portland Cement Co.'s Fort Worth, Texas, plant....Nov. 28 33
—— Virginia Portland Cement Co.'s plant.... ....Nov. 28 65

Cement products:
—— Aerated cement houses on exhibit at London show....Oct. 17 82
—— Comparison of aggregates used in the manufacture of....July 25 71
—— Concrete masonry chosen for ideal fire-safe home....May 2 80
—— Designing a mixture for....Mar. 7 70
—— Effect of flat particles in concrete aggregate....May 30 65
—— Following up the quality idea. D. R. Collins....June 27 63
—— Growth of....Jan. 10 69
—— John J. Earley, The work of....May 2 79
—— Lighting standards as cement products. A. J. R. Curtis....Oct. 17 67
—— Manufacture as a side line for sand and gravel producers. A. J. R. Curtis.... ....Jan. 24 71
—— Manufacturers discuss better graded aggregates....Feb. 7 69

Cement Products (continued)
—— New developments in colored cement stuccos ..... Aug. 22 41
—— Ohio building code gives recognition to ..... May 16 77
—— Ornaments and trim-stone from sand and gravel ..... Oct. 31 75
—— Recommended practice for making ..... Mar. 7 72
—— Review for 1925 ..... Dec. 26 149
—— Stone tile business in southern California ..... Aug. 8 77
—— Success in making. E. W. Dienhart ..... May 30 66
—— Wisconsin state fair exhibits ..... Oct. 3 77
Cement products plants:
—— Art Stone Co., Sioux City, Iowa ..... Oct. 31 75
—— Bernardsville (N. J.) Concrete Products Co. ..... July 11 73
—— Cinder Block Co. of St. Louis, Mo. ..... Aug. 22 75
—— Cunard-Lang Co. of Columbus, Ohio ..... Aug. 8 75
—— Egbert Concrete Products Co. plant ..... May 16 75
—— Ellis Concrete Products Co. plant ..... Sept. 19 77
—— Grant Whitmore plant ..... Sept. 5 109
—— Ideal Cement Stone Co.'s plant at Omaha ..... Nov. 28 81
—— Indianapolis Concrete Products Co.'s plant ..... Mar. 21 73
—— Longview Concrete Pipe Co. ..... Oct. 3 78
—— Rath Construction Products and Cement Co. ..... Apr. 18 73
—— Roslyn Concrete Products Co. ..... June 13 77
—— South Hills Hardware Co., Pittsburgh, Penn. ..... Nov. 14 79
Changes made in specifications for crushed-stone railway ballast ..... Mar. 21 34
Chassevent, M. L.: A high strength gypsum plaster ..... Nov. 28 64
Chemical engineering catalog for 1925 ..... Oct. 31 80
Chemical show at New York September 28 to October 3 ..... Oct. 17 48
Chicago council repudiates charges against John J. Sloan ..... July 25 70
Chicken grits—As to the market for ..... Oct. 31 41
Ciment fondu: Some English experiments with ciment fondu as binder for macadam roads ..... May 2 53
Cinder Block Co. plant ..... Aug. 22 75
Cleves plant of the Ohio Gravel Ballast Co. ..... Oct. 17 31
Cleveland Gypsum Co. formed at Cleveland, Ohio ..... Jan. 24 70
Clinchfield Portland Cement Co.:
—— Clinchfield, Ga., plant ..... Sept. 19 66
—— Third unit to be added ..... Oct. 31 74
Coal: Expense calculation of in rotary cement kilns ..... Dec. 12 34
Coal-feeding device and special furnace for shaft lime likns, New ..... May 16 43
Coal mines: Rock dusting to prevent explosions in ..... Mar. 7 39
Coast Cement Co., Vancouver, B. C., to grind Belgian clinker at new plant ..... May 30 62
Coast Rock and Gravel Co. ..... Oct. 31 47
Coburn, S. E.: Lime—Its use in the treatment of industrial wastes ..... Oct. 31 42
Collins, D. R.:
—— Following up the quality idea ..... June 27 63
—— Gaining prestige for concrete products in Wisconsin ..... Apr. 4 77
Columbia Digger Co.'s plant ..... Oct. 31 45
Columbia Quarry Co.'s:
—— Plant at Krause, Ill. ..... Aug. 8 33
—— Valmeyer, Ill., plant ..... Sept. 5 53
Columbus, Ohio, Cunard-Lang Co. plant ..... Aug. 8 75
Concrete:
—— Applying concrete by compressed air ..... Sept. 5 111
—— Controlling strength of concrete without reference to fineness modulus ..... June 13 55
—— Difference in strength of investigation from two paving projects. C. L. McKesson ..... Nov. 14 50
—— Effect of fine grinding of portland cement on strength of ..... Aug. 22 87
—— Effects of powdered admixtures in ..... Aug. 8 49
—— Fluorine compounds on ..... Nov. 14 59
—— Growth of roads in U. S. ..... Aug. 22 90
—— Hoover Building Code Commission on concrete units ..... Aug. 22 77
—— How it is self cleaning ..... June 13 78
—— In 1925 ..... Dec. 12 38
—— In the Santa Barbara earthquake ..... July 25 80
—— Making a white finish on ..... June 13 79
—— Making quick-hardening concrete of standard portland cement ..... Aug. 8 52
—— New design of poles eliminates maintenance costs ..... Sept. 5 110
—— Pavement aggregates ..... Mar. 21 51
—— Plain and reinforced ..... Nov. 14 73
—— Products at the American Concrete Institute ..... Mar. 7 69
—— Roads, what goes into a mile of ..... Aug. 8 70
—— Should be proportioned by weight ..... Aug. 22 38
—— West Coast block and tile industry. E. Shaw ..... Dec. 12 65
Concrete Aggregates, Ltd., Chiswick, England ..... Oct. 3 43
Concrete blocks:
—— Pouring method for ..... Mar. 21 75
—— Manufacture as a side line for sand and gravel producers. A. J. R. Curtis ..... Jan. 24 71
Concrete brick and tile; Bureau of Standards requirements for ..... June 13 79
Concrete products:
—— At the American Concrete Institute meeting ..... Mar. 7 69
—— Designing a mixture for ..... Mar. 7 70
—— Experiences as a manufacturer of. A. P. Burke ..... Jan. 10 33
—— Recommended practice for ..... Mar. 7 72
—— Success in making. E. W. Deinhart ..... May 30 66
Concrete tile: A unique demonstration of fire resisting properties of. Fred T. Abram ..... Feb. 21 75
Connecticut Quarries Co. reorganized ..... Jan. 10 61
Consolidation of California sand and gravel companies ..... Feb. 7 62
Construction Materials Co. plant ..... Feb. 7 27
Continental Rock Asphalt Co. bankruptcy to be investigated ..... Dec. 12 64
Control of quality in tile and block manufacture ..... Jan. 10 67
Controlling strength of concrete without reference to fineness modulus ..... June 13 55
Cooper, A. B., Inc., crushing plants ..... July 25 51
Co-operative compensation insurance. R. N. Van Winkle ..... May 2 40
Correction:
—— Albany Crushed Stone Co., article in October 31st issue ..... Nov. 14 51
—— Alles, A. A., of article in October 31st issue ..... Nov. 14 67
Cost accounting in the cement industry. **O. N. Lindahl** ..... Mar. 21 64
Cost and surplus charts ..... May 2 91
Cost of large scale crushing ..... Dec. 12 61
Cost charges of development work ..... Nov. 28 61
Cost finding and its problems in the sand, gravel and quarry industries. Part VI —Labor records for sand and gravel plants. Alfred Baruch ..... Oct. 17 35
Cost figures that help you sell. William R. Basset ..... Jan. 10 66
Croton Sand and Gravel Corporation plant ..... June 13 44
Crushed stone: (See Aggregate also)
—— Changes made in specifications for crushed-stone railway ballast ..... Mar. 21 34
—— De Val test for. Tyrell B. Shertzer ..... Apr. 4 41
—— Los Angeles' new ordinance requires weighing of ..... Nov. 28 76
—— Mining for extensively adopted around Kansas City. E. Shaw ..... Sept. 5 94
—— Munger Rock Co. has modern plant near Phoenix, Ariz. ..... Sept. 5 97
—— Plants: see quarries
—— Production, 1924 ..... Aug. 22 48
—— Removing of clay from ..... Feb. 21 42
—— Review for 1925 ..... Dec. 26 93
—— Standardization of specification for. C. L. McKesson ..... Nov. 28 62
—— Tests and their relation to the service of the finished pavement. A. T. Goldbeck ..... Jan. 24 46
—— Washing methods. Edmund Shaw ..... Feb. 21 42
—— Where it is a byproduct ..... June 27 39
Crushing plants: see quarries
Crushing quartzite to aggregate and ballast ..... Mar. 21 49
Cunard-Lang Concrete Block Co., Columbus, Ohio, a plant which makes blocks of washed limestone and sand ..... Aug. 8 75
Curtis, A. J. R.:
—— Concrete block manufacture as a side line for sand and gravel producers ..... Jan. 24 71
—— Lighting standards as cement products ..... Oct. 17 69

D

Dann, Alex. W.: Making gravel from sand ..... Jan. 10 32
Davidson Granite Co.'s plant near Lithonia, Ga. ..... June 27 39
Davis, J. R., paper at the National Safety Council ..... Oct. 17 45
Deep hole drilling with hammer type drills. Joseph A. Walshe ..... May 30 46
Deinhart, E. W.: Success in making concrete products ..... May 30 66
Demurrage lifted by lack of written notice (I. C. C. decision) ..... June 27 67
Depletion: What it means ..... Sept. 5 55
Derrick transportation at Boston Trap Rock Co.'s plant ..... May 2 43
Determining elasticity of stone ..... Feb. 21 67
Detroit Sand-Lime Products Co. plant. C. A. Breskin ..... Apr. 18 43
De Val test for crushed stone, The. Tyrell B. Shertzer ..... Apr. 4 41
Developments at the South Dakota state cement plant ..... Apr. 4 67
Diamond Sand Co.'s plant. J. R. Thoenen ..... Dec. 12 39
Diatomaceous Earth company operating in Nevada ..... Feb. 7 40
Diesel engines as prime movers in a gypsum plant. W. C. Stevenson ..... Apr. 4 62
Diesel engines for rock products plants. R. H. Bacon ..... Mar. 7 43
Dissolution of Cement Securities Co., official statement ..... Jan. 24 68
Dittlinger Lime Co. plant at Dittlinger, Texas. (Aeroplane photo) ..... July 25 57
Dixie Portland proposed improvements ..... Dec. 12 62
Double unit sand and gravel plant, A ..... Apr. 4 55
Dolomite:
—— Dolomite Products Co. plant at Rochester, N. Y. ..... Apr. 18 31
—— Magnesium carbonate and magnesia from ..... Aug. 22 60
—— Obtaining a chemically pure magnesium carbonate, From ..... Aug. 8 54
—— Use of in cyanide process ..... Jan. 10 80
Dredge:
—— M. A. Callahan Sand Co., Cleveland, Ohio, dredge "W. T. Rossiter" ..... May 16 45
—— "Kelley Island" capsizes in Lake Erie ..... May 16 74
—— Niagara Sand Corporation dredge "Weston M. Carroll" ..... Oct. 3 47
—— "W. T. Rossiter" destroyed by lightning ..... Oct. 3 79
Duchez, J. E.:
—— On the constitution and burning of artificial portland cement. Part 7 ..... Jan. 10 56
—— On the constitution and burning of artificial portland cement. Part 8 ..... Apr. 18 45
—— On the constitution and burning of artificial portland cement. Part 9 ..... July 25 45
—— On the constitution and burning of portland cement. Part 10 ..... Aug. 8 48
—— On the constitution and burning of artificial portland cement. Part 11 ..... Oct. 3 50
J. N. Dugan, sand and gravel plant, Cincinnati, Ohio ..... Oct. 3 44
Duquesne Slag Co. expands ..... Apr. 18 72

E

Earnshaw, George M.:
—— Carbon Limestone Co. plant at Hillsville, Penn. ..... Nov. 14 45
—— Massilon Sand and Gravel Co. plant remodeled ..... Sept. 5 87
—— New Southwestern Portland Cement Co. plant ..... Sept. 19 55
Eaton-Kastner Gravel Co.'s plant at Indianapolis, Ind. ..... Apr. 4 55
Economics of soil liming studied. John A. Slipher ..... Sept. 5 59
Edison Cement Co. improves plant ..... Aug. 8 77
Editorial Comment:
—— A healthy condition; A generally unappreciated asset; American waste ..... Nov. 14 69
—— An editorial by La Fay Pace; A busy January; A chance for co-operation ..... Oct. 31 71
—— A monument to an industry; Sauce for the goose, etc. ..... Aug. 22 71
—— Association activities ..... June 13 71
—— British cement, A new ..... Feb. 7 59
—— Coal situation, The ..... Apr. 18 71
—— Competition getting keener ..... June 27 61
—— Concrete aggregate ..... Feb. 21 61
—— Concrete by weight ..... Mar. 7 63
—— Concrete products aggregate ..... Feb. 7 59
—— Concrete, The future of ..... Feb. 21 61
—— Congratulations all around! ..... July 25 59
—— Costly lesson, A ..... Apr. 4 73
—— Depreciation and state cement plants ..... Dec. 12 59
—— Developing the crushed stone industry ..... May 16 65
—— Dolomite possibilities ..... Apr. 18 71
—— Frankness with the public ..... Feb. 7 59
—— Function of trade papers, The ..... Jan. 24 69
—— Government ownership ..... Mar. 7 63
—— "He said a mouthful" ..... May 16 65
—— Highway official, The ..... Mar. 21 69
—— Inconsistent but true ..... June 27 61
—— Industries founded on rock ..... Sept. 19 75
—— Irony in these scientific facts; A triumph of business ..... Oct. 17 63
—— "Kelley Island," Loss of ..... May 16 65
—— Kelly tariff rate rule ..... Jan. 24 69
—— Lime as a chemical; Conflicting testimony ..... Sept. 5 101
—— Neither boom nor slump ..... Feb. 21 61
—— Oil-engine power ..... Apr. 4 73
—— Our industries not localized ..... Aug. 8 69
—— Parallel roads ..... Jan. 10 63
—— Phosphate industry ..... Nov. 28 69
—— Plaster sands ..... May 2 77
—— Pointers on selling ..... Aug. 8 69
—— President Coolidge's message ..... Dec. 12 59
—— Producer "pays the freight" ..... Mar. 21 69
—— Producers studying aggregate ..... May 2 77
—— Quick hardening concrete ..... Feb. 7 59
—— Quotations—Our price ..... Sept. 19 75
—— Rate increase opposition ..... Dec. 12 59
—— Rate increases—Fight freight ..... Sept. 19 75
—— Re: Rock products specialties; No car shortage in sight ..... Oct. 3 69
—— Responsibility for workmanship ..... May 2 77
—— Rock dust for coal mines ..... Mar. 7 63

Editorial Comment (continued)
—— Rock products have unlimited market.... Feb. 7 59
—— Rock products securities.....July 11 69
—— Safety trophies.....June 13 71
—— Sand and gravel convention.....Jan. 10 63
—— South Dakota state cement plant..Nov. 28 69
—— Specifications for cement.....July 11 69
—— State mismanagement.....July 11 69
—— Surface and fineness moduli.....Apr. 4 73
—— Testing concrete for highways....Mar. 21 69
—— What is sand?.....June 13 71
Editorial correspondence:
—— Aggregate by weight.....Nov. 28 69
—— A swing through the West. Chas. A. Breskin.....May 2 71
—— Concrete building units on the West coast. E. Shaw.....Dec. 12 65
—— Editor's impression at Columbus and Philadelphia.....Apr. 4 65
—— Geology of greatest cement producing district.....July 25 63
—— Gypsum products industry in the northwest.....Oct. 17 38
—— Mining for crushed stone around Kansas City.....Sept. 5 95
—— Mining for crushed stone extensively adopted around Kansas City. E. Shaw.....Sept. 5 95
—— New ideas and methods in Pacific coast and southwestern states.....Nov. 14 63
—— Rock products activities in the East..... July 11 43
—— Rock products industry in the northwest .....Oct. 3 40
—— Sand and gravel industry of the west coast.....Oct. 31 44
—— Substantial new plants reflect experience of seasoned producers. E. Shaw..... May 16 66
—— The aggregate industry in the Dakotas and Nebraska.....Sept. 19 40
—— Visit to Indiana sand and gravel plants .....Mar. 21 52
—— Work of the Bureau of Public Roads. E. Shaw.....May 2 68
Effect of lignite on concrete sand.....Feb. 7 43
Effect of moisture in sand, The. R. R. Litehiser.....Apr. 4 58
Egbert Concrete Products Co. plant in Brooklyn, N. Y.....May 16 75
Ellis Concrete Products Co., Bridgeport, Conn., Henderson station.....Sept. 19 77
Engineers study inundation method of making concrete.....June 13 74
English Quarry Managers' convention..May 2 51
Expanding fiield of highway research....Aug. 22 38
Explosions—Coal dust, Rock dust as preventive of.....Nov. 14 72

F

Factors governing lime kiln capacity. Victor J. Azbe.....Mar. 21 41
Feldspar plants: New York Feldspar Corp. .....Mar. 21 36
Feldspar—Why small mines fail.....Nov. 14 83
—— Production in Canada for 1924....Aug. 8 88
Ferro-phosphorus, manufacture of in electric furnace.....May 30 88
Filming the lime industry. Henry M. Camp .....July 11 33
Financial news and comment:
—— Arundel earnings for half 1925.....June 27 60
—— Arundel earnings for eight months of 1925.....Oct. 31 70
—— Arundel dividend.....Apr. 4 72
—— Asbestos Corporation dividends....June 13 70
—— Atlas Cement change in capitalization.... .....Apr. 4 72
—— Bessemer Limestone and Cement Co. dividends.....June 13 70
—— Bessemer Limestone and Cement extra dividend.....Nov. 28 67
—— Canada Asbestos merger off.....Aug. 8 68
—— Canada Cement shows good business record. Roy Carmichael.....June 27 60
—— Canada Cement's new high.....Aug. 22 69
—— Canada Crushed Stone Corp. bonds..... .....May 30 58
—— Celite capital increase.....Aug. 22 69
—— Celite dividends.....Aug. 22 69
—— Celite dividends.....Nov. 28 67
—— Charles Warner Co.'s annual statement.... .....Mar. 21 68
—— Connecticut Quarries bonds.....May 2 76
—— Construction Materials new financing.... .....June 27 58
—— Consumers Co. new financing.....Dec. 12 60
—— Diatomaceous Products reorganization.... .....Nov. 28 67
—— Dolese and Shepard reduces capital stock .....Apr. 4 72
—— Grant and Wolverine Portland listed on N. Y. Exchange.....Oct. 3 68
—— Giant preferred dividends.....Dec. 12 60
—— Hermitage Portland dividends.....Feb. 7 35
—— International Cement Co. 1925 - 1924 earnings.....Sept. 5 100
—— International Cement earnings for 1924.... .....Apr. 18 70
—— International Cement new stock issue .....July 11 68
—— International Cement range.....Oct. 31 70
Financial News and Comment (continued)
—— International Cement's steady expansion .....Apr. 18 70
—— International preferred listed.....Nov. 28 66
—— Kansas sale of Miss. Rock Asphalt Co. bonds authorized.....Aug. 22 69
—— Lake Shore Stone Co. receivership..... .....Dec. 12 60
—— Lyman-Richey bond offering.....June 27 59
—— National Cement (Can.) refinancing..... .....Nov. 28 67
—— New England Lime bonds.....July 25 58
—— New England Lime class "B" preferred stock.... .....Oct. 17 62
—— New England Lime new preferred stock offering.....Sept. 5 100
—— North American bonds listed.....Nov. 28 66
—— North American Cement developments.... .....Oct. 31 70
—— North American Cement financing..... .....Aug. 22 68
—— North American earnings.....Nov. 28 66
—— North American preferred sales..Nov. 28 66
—— Olympic Cement 1924 earnings....Aug. 8 72
—— Ottawa Silica bonds called.....Nov. 28 68
—— Pacific Portland notes.....Sept. 19 74
—— Peerless Cement bonds.....Apr. 4 72
—— Portland Missouri to retire bonds..Nov. 14 68
—— Rhodes Jamieson Co. bond offering..... .....Dec. 12 58
—— Sandusky dividends.....July 11 75
—— Santa Cruz stock reaches par.....Apr. 18 70
—— Security Cement and Lime bonds called .....Oct. 17 62
—— Security-Helderberg Co. merger..Aug. 22 72
—— Southern Phosphate again shows deficit .....June 27 58
—— Standard Silica bonds offered.....Nov. 28 66
—— Stock quotations of rock products corporations.....Mar. 21 68
—— .....Apr. 4 72
—— .....Apr. 18 70
—— .....May 2 76
—— .....May 16 64
—— .....May 30 58
—— .....June 13 70
—— .....June 27 58
—— .....July 11 68
—— .....July 25 68
—— .....Aug. 8 68
—— .....Aug. 22 68
—— .....Sept. 5 100
—— .....Sept. 19 74
—— .....Oct. 3 68
—— .....Oct. 17 62
—— .....Oct. 31 70
—— .....Nov. 14 68
—— .....Dec. 12 58
—— .....Dec. 26 156
—— Superior Portland refinancing.....Dec. 12 60
—— Superior Sand and Gravel bonds....Oct. 3 68
—— Tidewater Cement receivership.....Aug. 8 58
—— Union Rock Co. bonds.....June 13 70
—— Universal Cement 1924 developments..... .....Aug. 22 69
—— U. S. Gypsum Co. balance sheet..May 16 64
—— U. S. Gypsum dividends.....Nov. 28 67
—— U. S. Gypsum extras.....Aug. 22 69
—— U. S. Gypsum may acquire Beaverboard.....Nov. 28 67
—— U. S. Gypsum restrains infringers of patents.....Oct. 17 62
—— U. S. Gypsum and Wolverine range .....Nov. 28 67
—— Virginia-Carolina Chemical Co. reorganization.....Nov. 28 66
—— Wabash Cement notes.....June 27 58
—— Wabash Portland bonds.....May 2 76
—— Wolverine Cement passes dividend..... .....Nov. 14 68
—— Wolverine Cement earnings.....Apr. 4 72
—— Wisconsin Lime and Cement bonds..... .....May 16 64
Fine grinding limestone and barytes....Mar. 21 37
Fink, G. J.: Research activities of National Lime Association.....Sept. 5 65
"Fireless cooker" for increasing efficiency of rotary lime kilns.....July 11 36
Fisher, H. L., Lime in the manufacture of rubber.....Sept. 5 56
Fletcher's, R. C., Iowa crushed stone plant .....Aug. 22 42
Florida:
—— Review of rock products industries. J. R. Thoenen.....Nov. 14 74
—— State limestone report. Reviewed by Oliver Bowles.....July 25 33
Florida Rock Products Co. building cement plant and enlarging crushing plant..... .....June 13 86
Fluorspar in 1924.....May 30 47
Flourspar in 1925.....Dec. 26 142
Flux stone plants: American Lime and Stone Co.'s plants at Union Furnace, Penn. .....Dec. 12 35
Ford, Henry, finds service, not dividends, best in business.....Nov. 14 83
Foreign cement:
—— Statistics on French production in 1924 .....June 27 51
—— Tests show some inferior to American product.....June 27 49
Foundrymen's convention at Syracuse, N. Y., October 5 to 9.....Oct. 17 54
Franklin Limestone Co.'s Franklin, Ky., plant.....Feb. 21 33
Franklinville plant of the J. E. Carroll Sand Co.....Aug. 8 43
Freight rates. (See Traffic and Transportation) ..... ---
French cement industry production in 1924.... .....June 27 31
Fuller-Kinyon pumping system.....Dec. 26 166
Fuller's earth: Production in 1924....Apr. 18 36

G

Ganister:
—— An important form of silica. J. D. Hartman.....Aug. 8 55
—— Quarrying of ganister rock at the Hartman quarries.....Aug. 8 56
Gas producers in lime plants. Victor J. Azbe .....May 16 36
Gas producer reactions.....Aug. 22 53
Geiger, Charles: Western Road Show at San Francisco.....Dec. 12 46
General Crushed Stone Co.:
—— Adds a plant and improves others..... .....Mar. 21 72
—— Plant at Akron, N. Y.....May 16 61
—— Winchester, Mass., quarry.....Aug. 22 46
General Insulating and Manufacturing Co. plant. J. R. Thoenen.....Feb. 21 39
Geology of the greatest cement producing district. Edmund Shaw.....July 25 63
German:
——Cement industry in 1924.....May 16 60
—— Opinions and experience with superportland vs. alumina cements..July 11 48
—— Portland cement makers discuss technical progress and American methods.... .....May 30 39
Glass, E. Earl: Weighing vs. measuring aggregate for concrete.....Nov. 28 59
Gold dust from our waste flume.....Sept. 5 118
—— .....Oct. 31 88
Goldbeck, A. T., director of Engineering Bureau, N. C. S. A.....Oct. 17 56
—— Aggregate for concrete pavement..Mar. 21 51
—— Crushed stone tests and their relation to finished pavement.....Jan. 24 46
Golden Basalt Products Co. plant at Golden, Colo.....May 30 35
Goodwin-Gallagher Sand and Gravel Co.:
—— Gallagher plant. (Airplane view)..Apr. 4 60
—— King plaster sand plant. (Airplane view) .....May 30 52
—— Phoenix plant. (Airplane view)..Mar. 21 60
Government wins suit to hold Florida phosphate lands.....June 13 68
Graham Brothers, Inc.:
—— New barge.....Sept. 19 35
—— New sand and gravel plant.....Mar. 7 79
Granite Sand and Gravel Co.'s plants at Indianapolis, Ind.....Apr. 18 37
Grant Whitmore concrete pipe plant at Oxford, Mich.....Sept. 5 108
Gravel aggregate in concrete roads.....June 13 47
Gravel—Progress on standard gravel ballast specifications.....Oct. 17 34
Gray, George O., Northwest experiments with plaster sands.....May 2 37
Greerville Gravel Co.'s merge.....Nov. 28 76
Guadalupe Cement plans and proposed financing.....July 25 67
Gypsite:
—— Modern methods of mining and refining of gypsum and gypsum products. A. W. Tyler. Part 7.....Aug. 8 59
—— Tacomo company to develop a deposit.... .....June 27 48
Gypsum:
—— American Society of Testing Materials discusses cement and gypsum..Nov. 14 54
—— And gypsum products.....May 30 48
—— Anhydrous, possibilities for the commercial use of. I. Bencowitz.....Nov. 14 40
—— As a cure and preventative of animal diseases.....May 16 35
—— Canadian statistics for 1924.....June 27 53
—— Catalysts for reviving dead-burned..... .....July 11 50
—— Chicken grits. Prof. Geo. A. Olson..... .....Sept. 19 47
—— Cost of sheathing with gypsum board.... .....Sept. 19 52
—— Deposits, Standard Gypsum Co. to work San Marcos Island.....May 2 64
—— Effect of storage of calcined gypsum, linear expansion of plaster. L. E. Smith.....Oct. 3 54
—— In building construction.....May 30 43
—— In China.....Aug. 22 45
—— Manufacturers inspect "Structolite" building.....July 11 71
—— Mined and shipped in 1924.....Aug. 22 79
—— Modern methods of mining and refining. Part 5. Alva Warren Tyler.....Feb. 21 49
—— Modern methods of mining and refining gypsum. Part 6. A. W. Tyler....May 2 62
—— Modern methods of mining and refining gypsum products. Part 7. Alva Warren Tyler.....Aug. 8 59
—— National Gypsum Co. will make wall board near Buffalo.....Oct. 31 72
—— Outline of gypsum production, An. J. L. McK. Yardley.....Jan. 10 44
—— Plaster, high strength. M. L. Chassevent.....Nov. 28 64

Gypsum (continued)
—— Preparation and manufacture from mine to wall board. Charles A. Breskin....Feb. 7 52
—— Products industry of Seattle, Wash. Edmund Shaw....Oct. 17 38
—— Review for 1925....Dec. 26 124
—— Scottish cements of....Apr. 18 57
—— Scottish hydraulic gypsum developments, More about....June 27 53
—— Some possible commercial uses of gypsum other than plaster. P. O. Scribe....Sept. 19 50
—— U. S. decision in gypsum wall board patent case....Aug. 22 64
—— U. S. government specification for....May 30 60
Gypsum mortars: Factors affecting the time of set of mechanically mixed. L. E. Smith....Aug. 22 61
Gypsum plants:
—— Beaver Products Co. plant (American Cement Plaster division). C. A. Breskin....Feb. 7 52
—— Pacific Portland Cement Co., Cons., Gerlach, Nev., plant....Apr. 4 62
—— Pacific Portland Cement Co., Cons., Imperial Valley plant....May 16 53
—— Standard Gypsum Co.'s plant at Seattle....Dec. 12 48
Gypsum plaster:
—— Adhesion of gypsum plaster to concrete....Oct. 31 43
—— Government specifications for....May 2 45
Gypsum quarry: Blue Diamond's near Las Vegas, Nev. Kay M. Grier....July 25 47
Gypsum tile from calcium sulphate wastes....June 27 53

H

Hadden, S. C., executive secretary of Indiana Sand and Gravel Association....May 16 84
Ham River Grit Co....Oct. 3 43
Handling liquid oxygen....Jan. 10 66
Hartman, J. D.:
—— Ganister, an important form of silica....Aug. 8 55
—— Quarrying of ganister rock at quarries....Aug. 8 56
Hazel-Atlas Glass Co. sand plant....May 2 48
Heat process for treating phosphate rock....May 30 37
Hendrix, O. W.: Holston Quarry Co.'s plant....Apr. 4 44
Heney Gravel Co., Seattle, Wash....Oct. 31 44
High temperature insulation....Nov. 14 89
Highway materials problem, The....Mar. 21 44
Hillhouse Quarry, Troon, Scotland:
—— "A British trap-rock quarry"....Oct. 3 33
—— Gravity transportation—correction....Nov. 14 75
Hilts, H. E., back in cement industry..Aug. 22 72
Hints and Helps:
—— A novel storage and handling system....Aug. 22 66
—— Advised not to use old wire ropes on well drills....Aug. 22 66
—— Air compressors, portable. R. N. Van Winkle....Jan. 10 54
—— Air used to clean mine locomotives....June 27 56
—— Babbitts and babbitting. W. F. Schaphorst....Apr. 18 48
—— Ball-bearing crane motors....May 2 59
—— Bearings made of rubber. W. F. Schaphorst....May 2 59
—— Belt conveyor, Small home-made....Feb. 7 44
—— Bin discharge regulating device..Aug. 8 50
—— Bin framing method....Oct. 3 67
—— Blacksmiths and drill steel at quarry plants. F. J. MacDonald....Apr. 4 70
—— Blacksmith shop, Portable....July 11 66
—— Blasting, An unusual method of....Feb. 7 44
—— Boiler used to cool water for compressor....June 27 56
—— Bridge of old boiler tubes....Dec. 12 44
—— Building a jig....Mar. 7 49
—— Car for shipping silica sand....June 13 66
—— Carbon dioxide recorders. W. F. Schaphorst....May 2 58
—— Causes of conveyor belt wear....Feb. 21 45
—— Changing belt conveyor from horizontal to incline....Jan. 24 65
—— Clamp for bending plates. J. R. Thoenen....Aug. 8 51
—— Closing a gate at a distance....May 16 59
—— Combined roll and feeder for hydrator....Jan. 10 54
—— Concrete stave silos for rock products plants....July 11 67
—— Contact for mine locomotive wheels, Getting good....Apr. 18 48
—— Cleaning conveyor belts....Aug. 22 67
—— Cleaning screen for loading washed stone....Sept. 19 73
—— Conveyor tripper, A simple....May 16 59
—— Conveyor take-up pulleys, Home-made....May 2 59
—— Cut off used with gravity screens..Apr. 4 71
—— Design of crusher feed gate....Aug. 8 50
—— Device for starting centrifugal pump without priming....Mar. 7 49
Hints and Helps (continued)
—— Direct drive for rod mill....Apr. 18 48
—— "Don'ts" for rock drills....June 13 66
—— Doubling capacity of quarry incline....Oct. 3 66
—— Draining a sand bin....Mar. 21 62
—— Dump cars used by J. L. Shiely Co....May 2 58
—— Dust cap for a crusher, A novel....Jan. 10 55
—— Fastening crushing roll shells....Mar. 21 63
—— Fence of old pipe and rope....Feb. 21 45
—— Finger chute above a crusher. J. R. Thoenen....June 13 66
—— Flood lights for operating quarry at night....July 25 54
—— Frame for Hints and Helps....Oct. 31 69
—— Furnishing water to boilers in cold weather....Nov. 14 53
—— Gate and skirt boards for conveyor belt....Sept. 19 73
—— Gravity screening tower....Feb. 21 44
—— Heating aggregate in winter....Nov. 14 53
—— Keeping a gravel bank from caving in....Nov. 14 52
—— Keeping car brakes adjusted. J. R. Thoenen....June 13 66
—— Labor saving at the quarry pit....Jan. 10 54
—— Launder of waste materials....Sept. 19 72
—— Lighthouse for dredging operations....Apr. 18 49
—— Limestone testing with substitute for blast lamp....Dec. 12 45
—— Lining an elevator well below the water line....Sept. 5 98
—— Loading mixed sizes from bins....Nov. 28 55
—— Loading skips in a quarry. J. R. Thoenen....May 30 44
—— Lugs on hollow steel, Device for forming. J. R. Thoenen....May 30 45
—— Motor truck engines for driving rock crushers....Apr. 4 71
—— New uses for old machinery....Nov. 28 56
—— Notice of shipments....Mar. 7 48
—— Old freight cars for warehouses....Apr. 4 71
—— Old screen for crusher guard....Nov. 28 56
—— Pneumatic car dumpers....Sept. 5 98
—— Preventing shocks from starting boxes located in damp places....May 2 59
—— Preventing uncalcined plaster from leaking into hot pit. G. G. Watson....June 27 57
—— Protecting bucket elevators....Apr. 4 71
—— Protecting pump discharge from shock....May 2 58
—— Protecting the dragline hoist operator....Mar. 21 63
—— Pumping from sand stockpile....Feb. 7 45
—— Railway sand dryer, A....June 13 67
—— Removal of drill steel from chucks....Sept. 19 72
—— Removing large stones from dredge suction....Oct. 3 66
—— Repairing a pump shell....Sept. 5 99
—— Repairing a steam shovel boom by welding....Mar. 7 48
—— Repairing split conveyor belt....Jan. 10 54
—— Replacing roll shells....Nov. 14 53
—— Rescreening plant, Neat design for....May 16 58
—— Rescreening plant, Small....Feb. 21 44
—— Rock splitting....Dec. 12 45
—— Roller grizzly, Special use for....Apr. 18 48
—— Rope roller, self oiling....May 16 58
—— Sand cone for building stockpile..Feb. 21 44
—— Sand washing device, A good....May 30 45
—— Scheme for sorting clay lumps from crushed stone. H. L. Aldrich....
—— Screen, A simple shaking....Feb. 7 45
—— Screen shaft protection....Dec. 12 45
—— Screen to increase production 15%....Nov. 28 55
—— Screenings, Handling waste....May 16 58
—— Separating sand from pump discharge....July 25 54
—— Shelter house for men....Nov. 28 56
—— Shaking sieves for gravel testing..July 25 54
—— Shelter for man on picking belt..July 11 67
—— Shovel rack....Oct. 3 66
—— Simple rules for boiler efficiency. W. F. Schaphorst....June 13 67
—— Skip for charging and discharging kiln....June 27 57
—— Sluice screen for removing oversize....Dec. 12 44
—— Spray for washing gravel in bins....Oct. 3 67
—— Steam shovel dipper teeth, Use for old....Jan. 24 65
—— Stone crusher drive gives satisfaction. C. C. Hormann....Jan. 24 64
—— Stopping the little losses....May 30 45
—— Storage for gasoline....Aug. 8 50
—— Suspension bridge of old cables..Mar. 21 62
—— Swinging chute for loading cars....Sept. 19 72
—— Switch that may be thrown from the locomotive....July 25 55
—— Switch that may be thrown from locomotive....Aug. 22 67
—— Test a chain, How to....Jan. 24 65
—— Testing sands for shale. P. M. Hegdal....Dec. 12 44
—— Track switch, Home-made automatic....Apr. 18 49
—— Two good hints for coupling dredge pipe lines. H. E. Robinson....Aug. 22 67
—— Unloading a gravel barge....Nov. 14 52
—— Unloading coal....June 27 57
Hints and Helps (continued)
—— Washing gravel on an inclined belt conveyor; Safe loads on chains; Sluicing sand to storage; Repairing a gyratory crusher by oxy-acetylene welding; Sleeve holder for dredge pipe line....Oct. 17 ....
—— Water heating device for lime hydrator....Jan. 10 55
—— Welding in a screen....May 30 44
—— Welding outfit, Portable electric....July 11 66
—— Wire rope, New use for....July 25 55
—— Working a cableway excavator over a wide area....Sept. 5 99
Hoffman, C. P., "Use of the personal poster for safety work"....Sept. 19 48
Hollow building units, Building officials' conference to study....Jan. 24 75
Holston Quarry Co. plant at Strawberry Plains, Tenn. O. W. Hendrix..Apr. 4 44
Hoover Building Code Committee on concrete units....Aug. 22 77
How good roads are stimulating new mineral industry....Apr. 18 63
Hydration of Anhydrite—Work of U. S. Bureau of Mines on. Marie Farnsworth....Nov. 14 42

I

Idaho Marble Co. plant destroyed by fire....Aug. 22 74
Ideal Cement Stone Co.'s plant....Nov. 28 81
Illinois crushed stone producers reorganize....July 25 66
Illinois Sand and Gravel Association meeting....Mar. 21 53
Important problems in the lime industry with special reference to Ohio. Oliver Bowles....July 25 41
Indiana Gravel Co. enlarges plant....Feb. 21 69
Indiana Sand and Gravel Association's annual meeting....Dec. 12 56
Indianapolis Concrete Products Co. plant....Mar. 21 73
Industrial Review for 1925....Dec. 26 82
Inland Sand Co.'s plant at Marietta, Ohio....Feb. 21 57
Innovations in making sand-lime brick. Charles A. Breskin....Apr. 18 53
Insulation of lime and cement kilns. Edw. A. Phoenix....May 16 39
"Insulex," House built of....July 11 63
Insurance: Co-operative compensation insurance. R. N. Van Winkle....May 2 40
International Cement Corporation:
—— Buys Indiana Portland Cement Co., capital increase authorized....June 27 76
—— Expanding in South America....Feb. 7 60
—— Expansion in the south....July 25 65
—— Makes important appointments....Sept. 5 103
Interstate Sand and Gravel Co.'s new plant at Covington, Ind....June 27 29
Investigation—of the building industry by builders....Sept. 19 65
Iowa Limestone Co. plant....Aug. 22 42
Ireland Brothers to re-enter the quarry business....Sept. 19 71

J

Johnson, H. V.: Sand for plasters and mortars....Mar. 22 54

K

Kansas City sand firms merge....Feb. 7 62
Kansas Portland Cement Co.'s plant at Bonner Springs, Kan....June 13 49
Kearns, T. P.: Address at National Safety Council meeting....Oct. 17 47
Kelley combination tariff, Present status of....Mar. 7 50
Kieselguhr as a new building material..Aug. 8 74
Kieselguhr: Effect of heat on calcining mixtures of portland cement and..Nov. 28 51
Koenig, P., sand and gravel plant at Oxford, Mich....Nov. 28 52
Komnick, F.: Sand lime brick plant at Hamburg, Germany....Dec. 26 132
Kraus method of making quick setting lime plaster....Sept. 5 62
Krause, E. J., elected member of executive committee N. C. S. A....Aug. 22 72

L

L. and N. Stone Co. plant....Sept. 19 44
Leaseholds a depletable asset....July 25 82
Lehigh Portland Cement Co.:
—— Buys Bath portland cement plant..Mar. 7 64
—— Mitchell, Ind., plant winner of safety trophy....May 30 33
—— To operate Alsen's cement plant..Apr. 18 80
Lehigh Valley safety meeting....May 30 34
Leicester Lime Corporation's new plant....Mar. 21 43
Lewiston Portland Cement Co. plant, Developments and complication in building of....Sept. 5 102

Lime:
—— Bulletin on water softening by National Lime Association....Nov. 14 60
—— Cement mortars for cold weather use....Dec. 26 119
—— Filming the industry. Henry M. Camp....July 11 33
—— Hydraulic, manufacture of in France. E. C. Blanc....Nov. 28 47
—— Important problems in the lime industry with special reference to Ohio. Oliver Bowles....July 25 41
—— In dirt roads. Dean E. J. McCausland....Sept. 5 63
—— In the chemical industries....Sept. 5 56
—— In the manufacture of rubber. H. L. Fisher....Sept. 5 56
—— In treatment of dye and textile waste. F. D. Snell....Sept. 5 61
—— Its use in the treatment of industrial wastes....Oct. 31 42
—— Merger of Southern producers of..Nov. 28 75
—— Missouri conference held at Carthage....Aug. 22 74
—— Mitchell rate case ended....Jan. 10 65
—— Possibilities for much greater use of lime in treatment of locomotive boiler water....Nov. 14 60
—— Production in 1924....Sept. 5 60
—— Production of, in Canada for 1924..Oct. 3 53
—— Quick setting, patent by Albert A. Alles....Oct. 31 81
—— Recent work by the Bureau of Standards on gypsum and sand-lime brick..Oct. 31 60
—— Research activities of National Lime Association. G. J. Fink....Sept. 5 65
—— Review for 1925....Dec. 26 111
—— Specification for use in sugar industry....May 30 39
—— Specification for water purification....July 25 40
—— The determination of calcium and magnesium hydroxides in hydrated lime ....Oct. 17 42
—— Theory and practice of manufacture. Victor J. Azbe. Part 1....June 27 45
—— Part 2....July 11 38
—— Part 3....July 25 39
—— Part 4....Aug. 8 39
—— Part 5....Aug. 22 52
—— Part 6....Sept. 19 53
—— Part 7....Oct. 3 59
—— Part 8....Oct. 17 41
—— Tunnel kiln proposed for manufacture of. Chas. M. Pease....Oct. 3 61
—— U. S. interdepartmental conference on....July 25 62
—— Use in the treatment of industrial wastes. S. E. Coburn and E. S. Chase..Oct. 31 42
—— Use of lime for treating public water supplies to prevent corrosion and red water. J. R. Baylis....Sept. 5 59
"Lime campaigned" with the school children. Griffith Richards....May 2 52

Lime kilns:
—— Factors governing their capacity. Victor J. Azbe....Mar. 21 41
—— Efficiency of effect of volatile matter on. V. J. Azbe....May 2 60
—— Universal ignorance of shaft kiln operation....Apr. 18 50

Lime plants:
—— Batesville White Lime Co.'s plant at Arkansas. Tom Shiras....Feb. 7 41
—— Benton Lime and Stone Co.'s plant at Limestone, Ohio....Feb. 21 66
—— Bruns Hydrated Lime Co....Oct. 3 65
—— Callow Rock Lime Co.'s plant. R. P. Brown....Dec. 12 29
—— Dittlinger Lime Co., Dittlinger, Texas. (Airplane photo)....July 25 56
—— Leicester Lime Corp....Mar. 21 43
—— Marblehead Lime Co. to build new big rotary kiln plant at Chicago....Sept. 5 90
—— St. Genevieve Lime and Stone Co.'s plant at St. Genevieve, Mo....May 16 43
—— Security Cement and Lime Co.'s "Cal" plant at Berkeley, W. Va....May 16 33
Whiterock Quarries Co. hydrating unit..Aug. 8 71

Lime plaster:
—— Kraus method for making quick setting. E. Shaw....Sept. 5 62
—— Standard specifications for....July 11 37
Limestone plants. (See Crushed Stone Plants.)

Limestone:
—— A new use for ground limestone. James H. Burdett....Oct. 3 38
—— For sheet glass making....Apr. 4 47
—— In alkali manufacture....Apr. 18 52
—— Mining of....Oct. 31 43
—— Mining operations, Typical. J. R. Thoenen....July 11 40
—— Prize milch cows as "rock products." Cary A. Rowland....Sept. 19 46
—— Production of, in Florida, 1924....Oct. 31 73
—— Soil laboratory train in western Ohio gives another boost to....Nov. 14 76
Lime treated water and its effect on typhoid bacteria. R. D. Scott and G. M. McLure....Sept. 5 58
Lime treatment of water in the manufacture of raw water rice. A. S. Behrman....Sept. 5 57
Lindahl, O. N.: Cost accounting in the cement industry....Mar. 21 64
Litehiser, R. R.:
—— Proportioning concrete for a specified strength....Apr. 18 42
Longview Concrete Pipe Co.'s plant....Oct. 3 78
Los Angeles:
—— Keeps restriction on foreign cement....Sept. 5 102
—— Rock products producers form association....Jan. 24 77
Louisville Cement Co. makes hydraulic lime for plaster and stucco....May 16 35
Lubrication of rock products machinery....Oct. 31 66
Lyman-Richey Sand and Gravel Co.'s plants....Dec. 12 23

M

Magnesia-portland cement. Dr. K. Balthasar....May 16 50

Magnesite:
—— Production in Venezuela....Nov. 14 51
—— Production of in 1924....Apr. 18 72
—— Review for 1925....Dec. 26 144
—— Smaller 1924 exports of Austrian..Sept. 5 86

Magnesium carbonate:
—— And magnesia from dolomite....Aug. 22 60
—— Chemically pure from dolomite....Aug. 8 54
Manganese steel: Uses and properties of....Dec. 26 159
Manor plant of the Charles Warner Co....May 30 27
Manufacturers' division of the National Crushed Stone Association holds meeting....Oct. 31 73
Manufacturing problems of cement industry. John J. Porter....Feb. 21 46
Marblehead Lime Co. to build big rotary lime kiln plant at Chicao....Sept. 5 90
March building sets new record....Apr. 18 89
Market for sand and screenings, A future. Clarence D. Pollock....Jan. 10 58
Marquette Cement Co.'s plant at Cape Girardeau, Mo. (Airplane view)....Dec. 12 52
Marsh, Robert, Jr.: Quarrying rock for portland cement manufacture in California....Feb. 7 46
Maryland-West Virginia silica sand industry, The. Edmund Shaw....May 2 46
Massaponax Sand and Gravel Corp.'s operations near Fredericksburg, Va...July 25 34
Massilon sand and gravel plant remodeled. G. M. Earnshaw....Sept. 5 87
Masters, H. R.: New developments in plaster wall board drying....July 25 78
McCallie, A. P.: Blue Diamond lime mortar plant....Oct. 3 51
McCausland, Dean E. J.: Lime in dirt roads....Sept. 5 63
McKesson, C. L.: Standardization of specifications for sand, rock and gravel....Nov. 28 62
McLaughlin, F. F., of the France Stone Co.: Paper read at National Safety Council meeting....Oct. 17 43
McPherson, S.: What the British Quarry Association has done for the industry....Feb. 7 33

Menantico Sand and Gravel Co.:
—— New relay pumping plant....May 16 84
—— Plant....Feb. 7 36
Metal mines—Mechanical underground loading in. J. R. Thoenen....Oct. 31 59
Mica, production in 1924....Sept. 5 94
Michigan and Pennsylvania "soil doctor" trains....May 2 66
Mifflin Sand Co. plant at Lewistown, Penn....Feb. 21 52
Milch cows as "rock products." Cary A. Rowland....Sept. 19 46
Millard, E. F., plants....Feb. 21 52
Mineral agregate industry around Philadelphia. Edmund Shaw....Apr. 18 66
Mineral industry—How good roads are stimulating new....Apr. 18 63
Mineral wool and cement from a silicified lime rock. J. R. Thoenen....Feb. 21 39

Mining:
—— Mining and quarrying compared. Part 8. J. R. Thoenen....Apr. 18 34
—— Mining and utilization of Tennessee phosphate rock. Richard W. Smith....Apr. 18 59
—— Mining engineers discuss limestone and limestone products....Feb. 21 36
—— Processes of mining and refining gypsum. Part 5. Alva Warren Tyler....Feb. 21 49
—— Part 6. Alva Warren Tyler....May 2 62
—— Part 7. Alva Warren Tyler..July 11 61
—— Typical limestone mining operations. J. R. Thoenen....July 11 40
Missouri Portland Cement Co. adds two kilns to St. Louis plant....Aug. 8 74
Missouri Sand and Gravel Producers' semi-annual meeting....June 13 86
Missouri Valley Sand and Gravel Producers Association annual meeting....Dec. 26 158
Mitchell, Ind., plant of the Lehigh Portland Cement Co. wins safety trophy..May 30 33
Mitchell lime rate case decision....Jan. 10 65
Mixing sand by prescription....Apr. 18 41
Molding sands:
—— Deformation of....Oct. 31 48
—— George F. Pettinos plant at Millville, N. J....Oct. 31 49
Moler quarry wins safety trophy....Aug. 22 45
Monolith Portland Cement Co. takes long lease on Tehachapi deposits....Nov. 14 73
Moore, E. S., and T. G. Taylor: Quarrying silica for refractories....Mar. 21 32
Moroccan portland cement and lime....July 11 50
Mortar plant, Blue Diamond Service Corp., New York mixed....Oct. 3 51
—— Blue Diamond plant of J. C. Stewart Sand Co....June 13 73
Motor-truck operated quarry....Apr. 18 31
Moundsville Sand Co.'s plant....Apr. 4 49
Mountain Granite Co.'s plant near Lithonia, Ga....June 27 39

N

National Agricultural Limestone Association annual meeting....Jan. 24 42

National Crushed Stone Association:
—— British compliments of....Apr. 4 57
—— Membership campaign on....June 27 62
—— New director of Engineering Bureau of Association, A. T. Goldbeck....Oct. 17 56
—— New secretary, J. R. Boyd....Oct. 17 57
—— Plans endorsed by Mid-West C. S. A....Aug. 22 72
—— Reminiscences of. Nathan C. Rockwood....Oct. 17 57
—— Sets forth accomplishments and objectives....July 11 70

National Crushed Stone Association Convention (1925):
—— Agricultural Limestone section's meeting....Jan. 24 39
—— Directors report....Jan. 24 32
—— Elections....Jan. 24 32
—— Manufacturers exhibit at....Jan. 24 57
—— Papers read....Jan. 24 38
—— President J. J. Sloan's address....Jan. 24 33
—— Registration....Jan. 24 61
National Gypsum Co.'s proposed plant near Buffalo....Oct. 31 72
National Lime and Stone Co. buys Brokensword Stone Co....Apr. 4 54

National Lime Association Convention:
—— Agricultural section report....June 13 39
—— Committee reports....35
—— Election of officers....33
—— President's address....34
—— Research council meeting....42
—— Registration....43

National Lime Association:
—— Exhibit at Chemical Show....Oct. 17 48
—— Research activities of. G. J. Fink, chemical director....Sept. 5 65
National Research Council—Prof. S. S. Steinberg to be assistant director....Nov. 14 66

National Safety Council:
—— Meeting at Cleveland....Sept. 19 88
—— Meeting, cement mill and quarry section....Oct. 3 86
—— Quarry men hold first meeting....Oct. 17 43

National Sand and Gravel Association convention:
—— Committee reports....Jan. 10 31
—— Concrete Products section meeting Jan 10 41
—— Directors meeting....Jan. 10 27
—— Election....Jan. 10 28
—— Papers read at....Jan. 10 32
—— President's address....Jan. 10 29
—— Registration....Jan. 10 41
National Sand and Gravel Association holds committee meeting in Philadelphia....June 13 47
National meeting of Blue Diamond mortar producers....June 13 46
National Silica Products Co. plant....May 2 47

National Slag Association:
—— Cleveland, Ohio, gives fellowship to Ann Arbor....Oct. 17 65
—— Exhibit at Chemical Show....Oct. 17 52
—— Holds annual meeting....Apr. 18 72
New Brunswick lime producers combine....Apr. 4 69
New Egyptian Portland Cement Co.'s Port Huron plant. Charles A. Breskin....Apr. 4 35
New England Lime Co. under new management....July 25 62

New machinery and equipment:
—— Albaugh-Dover Mfg. Co.'s spur-gear reducer....May 2 88
—— Allis-Chalmers Co. heavy duty motors....Sept. 19 87
—— Allis-Chalmers Texrope drive....Nov. 14 89
—— American Cable Co. "Tru-lay" wire rope....Apr. 18 86
—— American Manganese Steel Co. Clark bridge dipper....June 13 84
—— Batcher bins....Dec. 12 75
—— Bates multi-wall paper bag....Sept. 5 105
—— Belt slip, Visual comparison of....Oct. 3 80
—— Bemis waterproof bags for quicklime....Oct. 17 75

New Machinery and Equipment (continued)

—— Blaw-Knox Co. concrete aggregate batcher....Mar. 21 80
——Blaw-Knox Dreadnaught clamshell bucket....Nov. 28 91
—— Brown Hoisting Machinery Co. gas shovel-crane....June 27 72
—— Brown recording pyrometers....Nov. 14 88
—— Bucyrus Co. new quarry shovel....May 2 88
—— Buttress gypsum tile machine....Aug. 8 84
—— Buttress gypsum wall board machine....June 27 72
—— Byers half-yard crane and shovel..Sept. 19 86
—— Chabelco chain....May 16 82
—— Chisholm-Moore Mfg. Co. electric hoist....Apr. 4 87
—— Colorado Iron Works improved impact screen....Feb. 21 82
—— Crusher bearing problems....Sept. 19 86
—— Davenport Locomotive Works 20-ton gas locomotive....Sept. 19 87
—— Deister Concentrator Co. "Leahy" vibrating screen....Mar. 7 79
—— Dings Magnetic Separator Co. magnetic pulley....Feb. 21 83
—— Dixie Machinery Mfg. Co.'s swing hammer mill....Sept. 5 104
—— Dorr thickener....Sept. 19 86
—— Eagle Iron Works gravel washer Feb. 7 79
—— Electric Blower Co. new portable dust blower....Mar. 21 81
—— Ersham wood fibre machine....Dec. 12 75
—— Farrell Foundry and Machine Co. flexible coupling....Oct. 31 82
—— Foos Gas Engine Co. Diesel engines....May 30 72
—— Foote Bros. Gear and Machine Co. speed reducers....Jan. 24 83
—— Ford light truck....May 30 73
—— Ford truck with new stake body..Apr. 4 87
—— Harnischfeger Corp.'s half-yard excavator....June 13 84
—— Harnischfeger truck and trailer crane....Oct. 31 82
—— Hercules Powder Co. new explosive for underground work....Sept. 5 104
—— Hoar Shovel Co. gasoline-electric shovel....Jan. 24 82
—— Holmes tongue and groove machine....Nov. 28 90
—— Hyatt roller bearings....Nov. 28 91
—— Hydrotator agitator and thickener....Dec. 12 74
—— International Motor Co. "Mack" truck body....Feb. 7 78
—— James (D. O.) Mfg. Co. worm-gear reducers....Feb. 21 83
—— Jeffrey Mfg. Co. rigid hammer crusher, New....May 30 72
—— Jones (W. A.) Foundry and Machine Co. friction clutch....May 2 89
—— Lewis-Shepard electric stacker....Oct. 31 83
—— Lincoln greasing system for cars..Aug.8 85
—— Link-Belt Co. malleable iron safety collar....Jan. 24 83
—— Littleford Bros. steel storage magazines....May 2 89
—— Manganese Steel Forge Co.'s dredge pipe....Aug. 22 84
—— Manganese Steel Forge Co.'s dredge chain links....Sept. 5 104
—— Marion Model 125 revolving steam shovel....July 11 81
—— McMyler Interstate No. 2 gas shovel....Oct. 17 75
—— Mead-Morrison "55" tractor....Oct. 17 54
—— Mill ball composition sought....Oct. 3 80
—— Mid-West 7-ton locomotive....May 16 82
—— Milburn low pressure cutting and welding torch....Aug. 22 85
—— Nordberg Mfg. Co. track shifter..July 11 80
—— Northwest Engineering Co. adds gooseneck boom to equipment....Sept. 19 86
—— Northwest Engineering Co. models 104 and 105 shovels....Mar. 7 79
—— Northwest Engineering Co. lever control for shovels....Apr. 18 87
—— Orville-Simpson Co. vibrating screen....Mar. 21 80
—— Oxweld portable acetylene generator....Dec. 12 74
—— Page Engineering Co. "Kleen out" bucket....May 16 83
—— Pennsylvania Crusher Co. coal crusher....June 27 73
—— Pittsburgh Steel Drum Co.'s "Hammer-all" drums....June 13 85
—— Plaster wall board dying, New developments in. H. R. Masters, manager Chicago office Coe Mfg. Co....July 25 78
—— Plymouth 18-ton gasoline locomotive....Feb. 7 79
—— Relative merits of cotton and jute sacks....Oct. 31 83
—— Review for 1925....Dec. 26 168
—— Robinson Mfg. Co. gyro-sifter....Jan. 10 76
—— Roper Crane and Hoist Works electric hoist....Jan. 24 83
—— Russell and Co. revolving steam shovel....Apr. 4 86
—— Ruston and Hornsby large draglines....Oct. 31 83
—— Sauerman Bros. roller bearing sheave for dragline operation....Feb. 21 82
—— Smidth, F. L., and Co. machine for handling cement from storage....July 25 79

New Machinery and Equipment (continued)

—— Smidth (F. L.) and Co. cement slurry agitator....Mar. 21 81
—— Specially designed Colorado highway maintenance truck....Aug. 8 85
—— Speeder Machinery Co.'s combination crane....Oct. 3 80
—— Staynew filter for compressors and engines....June 13 85
—— Stearns Conveyor Co. (54-in.) conveyor belt tripper....Apr. 4 86
—— Stephens-Adamson Mfg. Co. "Saco" type box car loader....Jan. 10 76
—— Symons Bros. Co. improvements on disk crusher....Jan. 24 82
—— The trend to the revolving shovel..Aug. 8 84
—— Vulcan Iron Works gasoline locomotive with air brakes....Feb. 7 78
—— Vulcan 20-ton locomotive....Aug. 22 85
—— Waugh turbo stoper....Nov. 28 91
—— Weldit Acetylene Co. "Gasaver" for welding torches....Feb. 21 82
—— Whitcomb 4-ton gasoline locomotive....Aug. 22 84

New York State Crushed Stone Association:

—— Meeting at LeRoy....July 11 46
—— Meeting at Utica, N. Y....Sept. 19 44
—— Visit to Watertown and Chaumont....Aug. 22 49

New York Feldspar Corp. plant....Mar. 21 36
New York Trap Rock Corp.'s Verplanck quarry plant....June 13 56

News of the industry:

—— ....Jan. 10 78
—— ....Jan. 24 84
—— ....Feb. 7 82
—— ....Feb. 21 84
—— ....Mar. 7 82
—— ....Mar. 21 84
—— ....Apr. 4 88
—— ....Apr. 18 90
—— ....May 2 92
—— ....May 16 86
—— ....May 30 74
—— ....June 3 88
—— ....June 27 78
—— ....July 11 86
—— ....July 25 84
—— ....Aug. 8 86
—— ....Aug. 22 88
—— ....Sept. 5 116
—— ....Sept. 19 90
—— ....Oct. 3 90
—— ....Oct. 17 84
—— ....Oct. 31 90
—— ....Nov. 14 92
—— ....Nov. 28 92
—— ....Dec. 12 76
—— ....Dec. 26 204

Niagara Sand Corp., Buffalo, N. Y.—New dredge "Weston M. Carroll"....Oct. 3 47
North Carolina talc industry....May 2 57
Northern Concrete Brick Works, Germantown, Philadelphia, Penn....Oct. 17 71
Northwest experiments with plaster sands. George O. Gray....May 2 37

O

Ohio Concrete Products Association building code revised....Oct. 17 71

Ohio Gravel Ballast Co.:

—— Cleves, Ohio....Oct. 17 31
—— Makes notable conveyor installation....Feb. 21 64

Ohio gypsum workers get instruction in first aid....June 27 53
Ohio Macadam Association holds annual meeting....May 2 75
Ohio River Gravel Co.'s plants on the Ohio river....Mar. 7 51
Ohio Sand and Gravel Producers Association joint meeting with N. C. S. A. executives....Aug. 8 64
Olson, Prof. Geo. A.: "Gypsum chicken grit"....Sept. 19 47
Operating concrete products plants in winter....Mar. 7 73
Outline of gypsum production, An. J. L. McK. Yardley....Jan. 10 44

P

Pacific coast and southwestern states new ideas and methods on. Edmund Shaw....Nov. 14 63
Pacific Coast Gypsum Co. goes to receiver....Apr. 4 75
Pacific Coast Sand and Gravel Association elect E. Earl Glass general manager....Oct. 3 49
Pacific northwest—Rock products industry in Pacific northwest....Oct. 3 40

Pacific Portland Cement Co.:

—— Notes offered....Sept. 19 74
—— Completes Imperial Valley gypsum plant....May 16 53
—— Gerlach, Nev., gypsum plant....Apr. 4 62

Paint, made from portland cement....Aug. 8 54
Pan-American Highway Association....Feb. 21 35
Pan-American Road Congress....July 11 70

Patents:

—— Alles, A. A., patent for quick setting lime plaster....Oct. 31 81

Patents (continued)

—— Cement and lime from oil shale....July 25 44
—— Cement plants of straight line design. J. C. Buckbee....Dec. 12 54
—— Gypsum block machine....Apr. 18 58
—— High alumina cements....May 30 63
—— Irving Warner's rotary lime kiln "fireless cooker" invention....July 11 36
—— Magnesium carbonate and magnesia from dolomite....Aug. 22 60
—— Porous concrete aggregate....June 13 79
—— Superthickener for cement....June 27 44

Pease, Chas. M.: "Tunnel kiln proposed for lime manufacture"....Oct. 3 61
Pennsylvania Glass Sand Co. plant....May 2 47
Peerless portland cement plant at Detroit. C. A. Breskin....Sept. 5 67

Petoskey Portland Cement Co.:

—— Doubles output....July 11 72
—— Reorganized....May 30 61

Pettinos, George F., molding sand plant of....Oct. 31 49
Phillips, Chas. E., new superintendent of Alabama portland cement plant....Aug. 22 74
Phoenix, Edw. A.: Insulation of lime and cement kilns....May 16 39

Phosphate:

—— Florida leads in production of in U. S.....Oct. 17 80
—— France's wealth....Nov. 14 75
—— Industry of Nauru and Ocean Islands active....Nov. 14 77
—— Mining and marketing Tennessee blue rock phosphate. Richard W. Smith....Oct. 3 73
—— Mining and utilization of Tennessee phosphate rock. Richard W. Smith....Apr. 18 59

Phosphate rock:

—— Analysis of....Feb. 7 32
—— Heat process for treating....May 30 37
—— Mined and shipped in 1924....June 27 75
—— Process for briquetting....May 30 61
—— Review for 1925. J. R. Bent....Dec. 26 120

Pine Mountain Granite Co. plant....June 27 39
Pioneer Sand and Gravel Co., Seattle, Wash. Description of plant....Nov. 14 33
Pittsburgh White Sand Co. plant....Aug. 22 39

Plaster board:

—— New developments in drying of. H. R. Masters....July 25 78
—— Rates....Aug. 22 79

Plaster sands, Northwest experiments with. George O. Gray....May 2 37
Platzmann, Dr. C. R.: Problems in cement and concrete research....May 2 54
Pollock, Clarence D.: A future market for sand and screenings....Jan. 10 58
Porter, John J.: Manufacturing problems of cement industry....Feb. 21 46
Port Crescent (Mich.) Sand and Fuel Co. plant....June 27 34
Portland cement. (See Cement.)

Portland Cement Association:

—— Annual meeting....Nov. 28 72
—— Cited as a model....June 13 65
—— Lays cornerstone for new home....Nov. 28 72
—— To build own home....Aug. 22 86

Poultry grit quarry byproduct. Cary A. Rowland....June 27 42
Pratt, Sandy: Advertising sand....Apr. 18 41
Preventing coal mine explosions....Aug. 22 51
Prices on Belgian cement....Apr. 18 47
Problems in cement and concrete research. Dr. C. R. Platzmann....May 2 54
Producers installing batchers....June 27 37
Production of rock products in Canada in 1924....May 2 45
Proportioning concrete for a specified strength. R. R. Litehiser....Apr. 18 42
Pumping finished cement. Charles A. Breskin....Apr. 4 35

Q

Quarries:

—— A. B. Cooper, Inc., plant....July 25 51
—— Albany Crushed Stone Co., Albany, N. Y....Oct. 31 33
—— American Lime and Stone Co.'s plants at Union Furnace, Penn....Dec. 12 35
—— Arabian Crushed Granite Co.'s plant....June 27 39
—— Belmont Gurnee Stone Co.'s plant....Dec. 12 41
—— Boston Trap Rock Co.'s plant at Hyde Park, Mass....May 2 43
—— Brandon Rock Products Corporation's plant at Brandon, Vt....Apr. 4 68
—— Brandon Rock Products Corporation stucco and terrazzo plant at Middlebury, Vt....July 11 47
—— Callanan Road Improvement Co., South Bethlehem, N. Y....Oct. 31 33
—— Columbia Quarry Co.'s at Krause, Ill....Aug. 8 33
—— Columbia Quarry Co., Valmeyer, Ill., plant....Sept. 53
—— Davidson Granite Co.'s plant....June 27 39
—— Dolomite Products Co. plant at Rochester, N. Y....Apr. 18 31
—— Florida Shell Rock Co.'s plant at Ocala. J. R. Thoenen....Nov. 28 43
—— Franklin Limestone Co.'s plant..Feb. 21 33
—— General Crushed Stone Co.'s plant at Akron, N. Y....May 16 61

Quarries (continued)
—— General Stone Co., Winchester, Mass., quarry of....Aug. 22 46
—— Golden Basalt Products Co. plant. C. A. Breskin....May 30 35
—— Golden Basalt Products Co. plant at Golden, Colo. Charles A. Breskin....May 30 35
—— Hillhouse Quarry Co., Troon, Scotland....Oct. 3 33
—— Holston Quarry Co. plant at Strawberry Plains, Tenn. O. W. Hendrix....Apr. 4 44
—— Iowa Limestone Co.'s plant at Alden, Iowa....Aug. 22 42
—— L. and M. Stone Co. plant....Sept. 19 44
—— Lithonia, Ga., crushed granite byproduct plants....June 27 39
—— New York Trap Rock Corporation's Verplanck quarry....June 13 56
—— Pine Mountain Granite Co.'s plant....June 27 39
—— Quincy's municipal quarry....June 27 41
—— R. C. Fletcher's Iowa plant....Aug. 22 42
—— Reliance Whiting Co. plant at Alton, Ill....Oct. 3 37
—— Rockville Quarry Co.'s plant near Harrisburg, Penn....Mar. 21 49
—— Steelton plants of the Bethlehem Mines Corporation....Mar. 7 36
—— Watertown Stone Products Co. plant....Aug. 22 49
Quarry accident record in 1924....Nov. 28 46
Quarry accidents, Who pays for? R. N. Van Winkle....Jan. 10 60
Quarrying rock for portland cement manufacture in California. Robert Marsh, Jr....Feb. 7 46
Quarrying silica for refractories. E. S. Moore and T. G. Taylor....Mar. 21 32
Quarrying the Ocala limestone in Florida. J. R. Thoenen....Nov. 28 43
Quartz—Canada production and importation of 1924....Oct. 31 53
Quebec—Productions and developments of the Quebec asbestos industry. Roy Carmichael....Aug. 8 88
Quick-hardening concrete of standard portland cement, Making....Aug. 8 52
Quicklime—Government specifications for....May 2 45
Quincy Municipal Quarry....June 27 41

R

Railroads help in promoting use of agricultural limestone. Henry M. Camp....Jan. 10 51
Rarey, Russell: Washing screenings to make fine aggregate....Jan. 24 45
Rate structure investigation....Oct. 31 79
Rath Construction Products and Cement Co. cement products plant at Indianapolis, Ind....Apr. 18 73
Red River Gravel Producers Association formed....May 16 84
Refractories:
—— British comments on lime kiln refractories....May 30 49
—— Lime kiln, tentative plan for investigation of. Victor J. Azbe....Feb. 21 55
Reinforcement:
—— Value of steel reinforcement in concrete roads....Aug. 8 61
Relay pumping installation on the Kaw river....Feb. 21 59
Reliance Whiting Co. plant at Alton, Ill....Oct. 3 37
Reminiscences of the National Crushed Stone Association. Nathan C. Rockwood....Oct. 17 57
Repairing bad order cars. W. E. Rogers....Jan. 10 33
Requirements of sand for sand blasting. W. M. Weigel....Feb. 7 31
Requirements of special sands. W. M. Weigel....Sept. 19 36
Richards, Griffith:
—— How we "lime campaigned" with the school children....May 2 52
Right kind of advertising to sell sand or any other aggregate....Jan. 10 43
Road building cost in England....June 27 49
Road building in the United States during 1924....Sept. 19 71
Roads, federal....Oct. 17 40
Rochester Sand and Brick Co.'s plant..Dec. 26 133
Rock Asphalt:
—— Develop Alabama rock asphalt....Aug. 22 41
—— Texas companies may combine..Aug. 22 72
Rock dust industry, Berks county, Penn. R. W. Stone....May 2 42
Rock dusting coal mines....Aug. 8 71
Rock dusting coal mines as an explosion preventative....Mar. 7 39
Rock dusting for coal mines, Bureau of Mines investigation of....Dec. 12 43
Rock formations, what quarrymen should know of....Jan. 10 50
Rock Products:
—— Activities in the East. Edmund Shaw....July 11 43
—— Activities of United States Bureau of Standards on....Apr. 18 62
—— In automobile tire manufacture....Oct. 31 53
—— Industry in California....Nov. 14 90
—— London representative....June 13 74
—— Production in Quebec (1924)....May 30 61
Rock Products Market:
—— ....Jan. 10 72
—— ....Jan. 24 78
—— ....Feb. 7 74
—— ....Feb. 21 78
—— ....Mar. 7 74
—— ....Mar. 21 76
—— ....Apr. 4 82
—— ....Apr. 18 82
—— ....May 2 84
—— ....May 16 78
—— ....May 30 68
—— ....June 13 80
—— ....June 27 68
—— ....July 11 76
—— ....July 25 74
—— ....Aug. 8 80
—— ....Aug. 22 80
—— ....Sept. 5 112
—— ....Sept. 19 82
—— ....Oct. 3 82
—— ....Oct. 17 76
—— ....Oct. 31 84
—— ....Nov. 14 84
—— ....Nov. 28 86
—— ....Dec. 12 70
Rock slides, once waste, now valuable. R. W. Stone....Mar. 21 31
Rockville Quarry Co.'s plant near Harrisburg, Penn....Mar. 21 49
Rockwood, Nathan C.:
—— Reminiscences of the National Crushed Stone Association....Oct. 17 57
Rogers, George A.:
—— Hits use of inferior rock products in building practice; educational campaign needed....Sept. 5 89
Rogers, W. E.: Repairing bad order cars....Jan. 10 33
Roofing tile plant, South Hills Hardware Co., Pittsburgh, Pa....Nov. 14 79
Roslyn Concrete Products Co. plant....June 13 77
Rowland, Cary A.:
—— Poultry grit, quarry by-product....June 27 42
—— Prize milch cows as "rock products."....Sept. 19 46

S

Safety:
—— Campaign: Moler quarry wins safety trophy....Aug. 22 45
—— Mine rescue contest....May 2 65
—— Stewart Sand Co. Safety Council organized....Dec. 26 158
—— Unveiling of safety trophies for....June 13 69
—— Work: Use of the personal poster for safety work. C. P. Hoffman....Sept. 19 48
Sales: Staff conferences for promotion of....July 11 72
—— And promotion....Jan. 24 50
Sand:
—— Bulking of moist....Feb. 7 80
—— Chart of car loadings from Jan. 1924 to Mar. 1925....Apr. 18 88
—— Classified; why it is best....Dec. 12 61
—— For lime, gypsum and cement plasters. H. V. Johnson....Mar. 21 54
—— Indiana....Apr. 14 44
—— Making blast and other special..Feb. 7 36
—— Making gravel from. Alex W. Dann....Jan. 10 32
—— Making of glass and polishing....Feb. 21 52
—— Ottawa sand companies to combine....Sept. 5 97
—— Production in Illinois (1924)....May 30 61
—— Requirements of special. W. M. Weigel....Sept. 19 36
—— Where sand is found ready for the market....Sept. 19 39
Sand and Gravel:
—— Industry of the West Coast. Edmund Shaw....Oct. 31 44
—— Labor records for sand and gravel plants. Alfred Baruch....Oct. 17 35
—— Loading of in freezing weather. R. Snoddy....Jan. 10 34
—— Los Angeles' new ordinance requires weighing of....Nov. 28 76
—— Men hold their ninth annual convention....Jan. 10 27
—— Michigan Highway Department investigates state resources....Dec. 12 63
—— National convention at Atlanta, Jan. 13-14....Aug. 22 90
—— Ohio river, dredging for. A. W. Williams....Nov. 28 58
—— Producers working with railways on ballast specifications....July 11 59
—— Production for 1924....Oct. 17 81
—— Production in Louisiana for 1924..Feb. 7 51
—— Production in New Jersey, 1924..Nov. 28 71
—— Research of Lyman-Richey Co. on....Dec. 12 23
—— Review for 1925....Dec. 26 102
—— Standardization of specifications for....Nov. 28 62
Sand and Gravel Plants:
—— Alfred Sand and Gravel Corp., Hornell, N. Y....Sept. 19 39
—— Atlas Sand and Gravel Co....Sept. 5 84
—— Bennett Gravel Co. plant....Sept. 19 33
—— Charles Warner Co.'s Manor plant near Tullytown, Penn....May 30 27
—— Columbia Digger Co....Oct. 31 45
Sand and Gravel Plants (continued)
—— Concrete Aggregates, Ltd., Chiswick, England....Oct. 3 43
—— Croton Sand and Gravel Corp.'s plant....June 13 44
—— Diamond Sand Co.'s plant. J. R. Thoenen....Dec. 12 39
—— Eaton-Kaster Gravel Co.'s plant at Indianapolis, Ind....Apr. 4 55
—— Granite Sand and Gravel Co.'s plants at Indianapolis, Ind....Apr. 18 37
—— Ham River Grit Co., Ham, England....Oct. 3 43
—— Heney Gravel Co....Oct. 31 45
—— Inland Sand Co.'s plant at Marietta, Ohio....Feb. 21 57
—— Interstate Sand and Gravel Co., Covington, Ind....June 27 29
—— J. C. Stewart Co. plant at Oxford, Mich....Oct. 31 54
—— J. L. Shiely's No. 3 sand and gravel plant. Franklin A. Alter....May 2 33
—— J. N. Dugan, Cincinnati, Ohio....Oct. 3 44
—— Koenig, P., Coal Co. plant at Oxford, Mich....Nov. 28 52
—— Lyman Richey Sand and Gravel Co.'s plants....Dec. 12 23
—— M. A. Callahan Sand and Gravel Co.'s dredge, W. R. Rossiter with 18-in. pump....May 16 45
—— Massaponax Sand and Gravel Corp., near Fredericksburg, Va....July 25 34
—— Massilon Sand and Gravel plant remodeled. G. M. Earnshaw....Sept. 5 87
—— Menantico Sand and Gravel Co....Feb. 7 36
—— Niagara Sand Corp. plant....Oct. 3 47
—— Ohio Gravel Ballast Co., Cleves, Ohio....Oct. 17 31
—— Ohio River Gravel Co.'s plants on the Ohio river....Mar. 7 51
—— Pioneer Sand and Gravel Co., Seattle, Wash....Nov. 14 33
—— Seaboard Sand and Gravel Co....Aug. 22 34
—— Stewart, J. C., No. 9 plant....Feb. 21 59
—— Stoney Creek Gravel Co., Orland, Calif....July 25 31
—— Visit to Indiana plants. Edmund Shaw....Mar. 21 52
—— Wisconsin Lime and Cement Co. at Crystal Lake, Ill. Gordon Smith—....July 11 51
—— Warner, Chas. Co., Manor plant..May 30 27
Sand carrying capacity of quick lime....Aug. 22 41
"Sandcraft," the largest of sand dredges....Feb. 7 27
Sand dredging fleet of the United Fuel and Supply Co., Detroit, Mich....Mar. 7 56
Sand-lime brick:
—— Adhesion of mortar to....Aug. 22 53
—— Review for 1925....Dec. 26 131
—— Strength tests on walls of....July 11 58
Sand-Lime Brick Association convention in 1925:
—— Election....Feb. 7 50
—— President's address....Feb. 7 50
—— Registration....Feb. 7 51
Sand-lime brick industry about Toronto....Dec. 12 57
Sand-lime brick plants: Sand-Lime Products Co., Detroit, Mich., plant. C. A. Breskin....Apr. 18 53
—— F. Komnick's plant at Hamburg, Germany....Dec. 26 132
—— Rochester Sand and Brick Co.'s plant....Dec. 26 133
Scherer, R. W.: Alumina cements vs. super portland cements....July 11 48
Scott, R. D., and McLure, G. M.: Lime treated water and its effect on typhoid bacteria....Sept. 5 59
Scottish hydraulic gypsum:
—— Developments, More about....June 27 52
—— Remarkable properties claimed for....Apr. 18 57
Scribe, P. O.: "Some possible commercial uses of gypsum other than plaster"....Sept. 19 50
Seaboard Sand and Gravel Co....Aug. 22 34
Searle, Alfred A.: British comments on lime kiln refractories....May 30 49
Security Cement and Lime Co.:
—— "Cal" plant at Berkeley, W. Va...May 16 33
—— Calls second mortgage bonds....Oct. 17 62
Service bins for aggregates, "Permanent"....Mar. 7 33
Shaft kiln operation, Universal ignorance of....Apr. 18 50
Shaw, Edmund:
—— American Society for Testing Materials holds annual convention....June 27 47
—— Concrete building units on the West coast....Dec. 12 63
—— Crushed stone washing methods....Feb. 21 42
—— Editor's observations at Columbus and Philadelphia....Apr. 4 65
—— Geology of the greatest cement producing district....July 25 63
—— Maryland-West Virginia silica sand industry....May 2 46
—— Mineral aggregate industry around Philadelphia, A tremendous....Apr. 18 66
—— Pacific coast and southwestern states....Nov. 14 63
—— Rock products activities in the east....July 11 43
—— Rock products industry in Pacific northwest....Oct. 3 40

Shaw, Edmund (continued)
—— Substantial new eastern plants reflect experience of seasoned producers..May 16 66
—— "The aggregate industry in Nebraska and the Dakotas".....Sept. 19 40
—— The gypsum products industry of Seattle, Wash.....Oct. 17 38
—— The sand and gravel industry of the west coast.....Oct. 31 44
—— Visit to Indiana sand and gravel plants, A.....Mar. 21 52
—— Work of the Bureau of Public Roads.....May 2 68
Sheathing, Cost of, with gypsum board.....Sept. 19 52
Shertzer, Tyrell B.: De Val test for crushed stone, The.....Apr. 4 41
Shiely, J. L.:
—— Ballast plants at Montana.....Apr. 18 69
—— New No. 3 sand and gravel plant at Minneapolis, Minn. Franklin A. Alter.....May 2 33
—— New system of truck delivery.....Aug. 8 42
Shiras, Tom: New lime plant of the Batesville White Lime Co., Arkansas..Feb. 7 41
Signal Mountain Cement Co. declares dividend.....May 2 74
Silica, Ganister an important form of. J. D. Hartman.....Aug. 8 55
Silica sand:
—— Maryland-West Virginia silica sand industry. Edmund Shaw.....May 2 46
—— Review for 1925.....Dec. 26 137
—— Silica sand and gravel industries at Pacific, Mo., growing.....May 2 90
Silica Sand plants:
—— Berkeley Sand Co.'s plant.....May 2 46
—— Boonville Sand Co.'s plant.....Sept. 19 45
—— Carroll's, J. E., Sand Co., Franklinville plant.....Aug. 8 43
—— Construction Materials Co. plant..Feb. 7 27
—— Goodwin - Gallagher Sand and Gravel Co.'s Gallagher plant. (Aeroplane view).....Apr. 4 60
—— Goodwin - Gallagher Sand and Gravel Co.'s Phoenix plant. (Aeroplane view).....Mar. 21 60
—— Goodwin - Gallagher Sand and Gravel Co.'s King plaster sand plant. (Aeroplane view).....May 30 52
—— Hazel-Atlas Glass Co. plant.....May 2 48
—— Mifflin Sand Co.'s plant at Lewistown, Penn.....Feb. 21 52
—— Millard, E. F., plant.....May 2 47
—— Moundsville Sand Co.'s plant near Wheeling, W. Va.....Apr. 4 49
—— Pettinos, Geo. F., plant.....Oct. 31 31
.....Aug. 22 39
—— Pennsylvania Glass Sand Co. plant.....May 2 47
—— Pittsburgh White Sand Co.'s plant.....
—— Port Crescent Sand and Fuel Co.'s plant at Port Crescent, Mich.....June 27 34
—— Speer White Sand Co. plant.....May 2 48
—— West Virginia and Pittsburg Sand Co. plant.....May 2 47
Sizes of stone for Pennsylvania state highway department.....Feb. 21 72
Slag: Standard Slag Co.'s plant at Youngstown, Ohio.....May 30 51
—— Review for 1925.....Dec. 26 141
Slate:
—— Flour used for waterproofing concrete products.....Feb. 21 77
—— Industry Conference program.....Dec. 26 143
—— Men hold annual meeting.....Feb. 7 66
—— Production in 1924.....Feb. 7 51
—— Review for 1925. Oliver Bowles..Dec. 26 142
—— Rock dust industry, Berks County, Penn. R. W. Stone.....May 2 42
—— Sale in 1924.....July 25 38
Smith, Gordon: Wisconsin Lime and Cement Co.'s sand and gravel plant near Crystal Lake, Ill.....July 11 51
Smith, L. E.: "Effect of storage of calcined gypsum linear expansion of plaster".....Oct. 3 54
Smith, Richard W.:
—— "Mining and marketing Tennessee blue rock phosphate".....Oct. 3 73
—— Mining and utilization of Tennessee phosphate rock.....Apr. 18 59
Snell, Foster D.: Lime in treatment of dye and textile waste.....Sept. 5 61
Snoddy, R.: Loading materials in freezing weather.....Jan. 10 34
Soapstone:
—— And talc in 1924.....June 11 75
—— Companies merge, Four eastern....July 11 75
South Dakota's state cement plant:
—— A losing proposition.....Nov. 28 77
—— Comments.....Jan. 10 53
—— Observation.....Mar. 7 58
South Hills Hardware Co.'s cement tile plant at Pittsburgh, Penn.....Nov. 14 79
Southwest Road Show to be held at Wichita.....Dec. 12 63
Southwestern Portland Cement Co.'s plant a monument to Carl Leonardt. Geo. M. Earnshaw.....Sept. 19 55
Southwestern states and Pacific coast new ideas and methods. Edmund Shaw.....Nov. 14 63
Spotted aggregate.....June 13 79
Standard and Pacific Coast Gypsum companies combine.....Mar. 7 62
Standard Gypsum Co.:
—— Plant at Seattle.....Dec. 12 48
—— ..To work San Marcos Island deposits.....May 2 64
Standard Portland Cement plant almost completed. G. M. Earnshaw.....Aug. 22 54
Standard Slag Co. builds its 17th crushing plant.....May 30 51
State ownership and operation, Some interesting experiences in.....Mar. 7 58
Steelton plants of the Bethlehem Mines Corp.....Mar. 7 36
Stevenson, W. C.: Diesel engines as prime movers in a gypsum plant.....Apr. 4 62
Stewart, J .C., Co.:
—— Oxford, Mich.....Oct. 31 54
—— Blue Diamond mortar plant at....June 13 73
Stewart, W. W., Sales manager Koppel Industrial Car and Equipment Co., paper read at National Safety Council..Oct. 17 46
Stone, R. W.:
—— Rock dust industry, Berks County, Penn.....May 2 42
—— Rock slides once waste, now valuable.....Mar. 21 31
St. Genevieve Lime and Stone Co.'s plant.....May 16 43
Stone-tile business good in California....Aug. 8 77
Stoney Creek Gravel Co.'s plant at Orland, Calif.....July 25 31
Straining for "effect" in block making..Jan. 10 69
Strength of concrete—Investigation of reasons for difference from two paving projects.....Nov. 14 50
Stuccos, New developments in colored cement.....Aug. 22 41
Sutton, E. Guy: Indiana Sand and Gravel Association's new president.....Dec. 12 56
Swing through the west, A. Charles A. Breskin.....May 2 71
Switch thrower, Automatic.....Oct. 31 68

T

Talc:
—— And pigment quarrying in Virginia Blue Ridge Talc Co.....Aug. 8 62
—— And soapstone in 1924.....June 27 75
—— And soapstone in 1925.....Dec. 26 140
—— Calcined hard as quartz.....Oct. 31 53
—— Increase of production in Canada during 1924.....Aug. 22 70
—— Used to strengthen and waterproof concrete.....Oct. 3 57
Taylor, T. G., and E. S. Moore: Quarrying silica for refractories.....Mar. 21 32
Terrazo (See Aggregate).
Thoenen, J. R.:
—— Diamond Sand Co.'s plant.....Dec. 12 39
—— Florida rock products industries.....Nov. 14 74
—— Mechanical loading in underground mines (Review).....Oct. 31 59
—— Mineral wool and cement from a silicified lime rock.....Feb. 21 39
—— Mining and quarrying compared. Part 8.....Apr. 18 34
—— Quarrying the Ocala limestone in Florida.....Nov. 28 43
—— Typical limestone mining operations.....July. 11 40
Thompson, Weinman and Co. plant at Cartersville, Ga.....Mar. 21 37
Tonnage basis is best, Why. T. H. Walton, Jr.....June 27 38
Towles, R. C., joins American Cyanamid Co.....Dec. 12 62
Trade association research activities.....Nov. 14 75
Trade associations to be advised on legal matters.....Oct. 17 80
Traffic and Transportation. Edwin Brooker.....
—— .....Jan. 24 76
—— .....Feb. 7 68
—— .....Feb. 21 70
—— .....Mar. 7 66
—— .....Mar. 21 82
—— .....Apr. 4 74
—— .....Apr. 18 76
—— .....May 2 82
—— .....May 16 82
—— .....May 30 64
—— .....June 13 75
—— .....June 27 66
—— .....July 11 82
—— .....July 25 68
—— .....Aug. 8 78
—— .....Aug. 22 77
—— .....Sept. 5 106
—— .....Oct. 3 70
—— .....Oct. 17 72
—— .....Oct. 31 79
—— .....Nov. 14 78
—— .....Nov. 28 85
—— .....Dec. 12 69
—— .....Dec. 26 154
Trinity Portland Cement Co. plant.....Nov. 28 33
Truck delivery, J. L. Shiely's new system of.....Aug. 8 42
Tunnel kiln proposed for lime manufacture. Chas. M. Pease.....Oct. 3 61
Tyler, Alva Warren:
—— Modern methods and processes of mining and refining gypsum. Part 5.....Feb. 21 49
—— Part 6.....May 2 62
—— Part 7.....July 11 61
—— Part 8.....Aug. 59
Typical limestone mining operations. J. R. Thoenen.....July 11 40

U

Union Rock Co. expands.....July 25 70
Unique demonstration of the fire resisting properties of concree tile. Fred T. Abram.....Feb. 21 75
United Fuel and Supply Co., Detroit, Mich., sand dredging fleet.....Mar. 7 56
Universal ignorance of shaft kiln operation.....Apr. 18 50
Universal Portland Cement elects new officers.....Sept. 5 108
U. S. Bureau of Mines:
Hydration of anhydrite. Marie Farnsworth.....Nov. 14 42
—— U. S. Bureau of Mines, Scott Turner, new director.....Nov. 14 73
U. S. Gypsum Co.:
—— Erecting paper plant at Oakfield, N. Y.....June 13 72
—— History.....Jan. 10 71
—— Improving plants.....Aug. 8 73
—— New lime plant at Cordova, Ill.....June 13 73
—— Patents upheld by U. S. district court.....Aug. 22 64
—— Restrains infringements of its patents.....Oct. 17 62
—— To enlarge west coast plants.....Apr. 4 75
U. S. Supreme Court decision in Cement Manufacturers' Protective Association case. (Full text).....June 13 61
Utah Copper Co. blasting methods.....July 25 50
Van Winkle, R. N.:
—— Accidents can be prevented.....Mar. 7 46
—— Co-operative compensation insurance.....May 2 40
—— Who pays for quarry accidents?..Jan. 10 60
Vermont plant for making terrazzo chips.....Apr. 4 68
Virginia sand and gravel companies combine.....Mar. 7 78
Visit to Indiana sand and gravel plants. Edmund Shaw.....Mar. 21 52
Volatile matter:
—— Its effect on lime kiln efficiency. Victor J. Azbe.....May 2 60
—— Its effect on lime kiln efficiency. Victor J. Azbe. (Continued from May 2 issue).....May 16 38

V

Virginia Portland Cement Co.'s plant at Norfolk.....Nov. 28 64

W

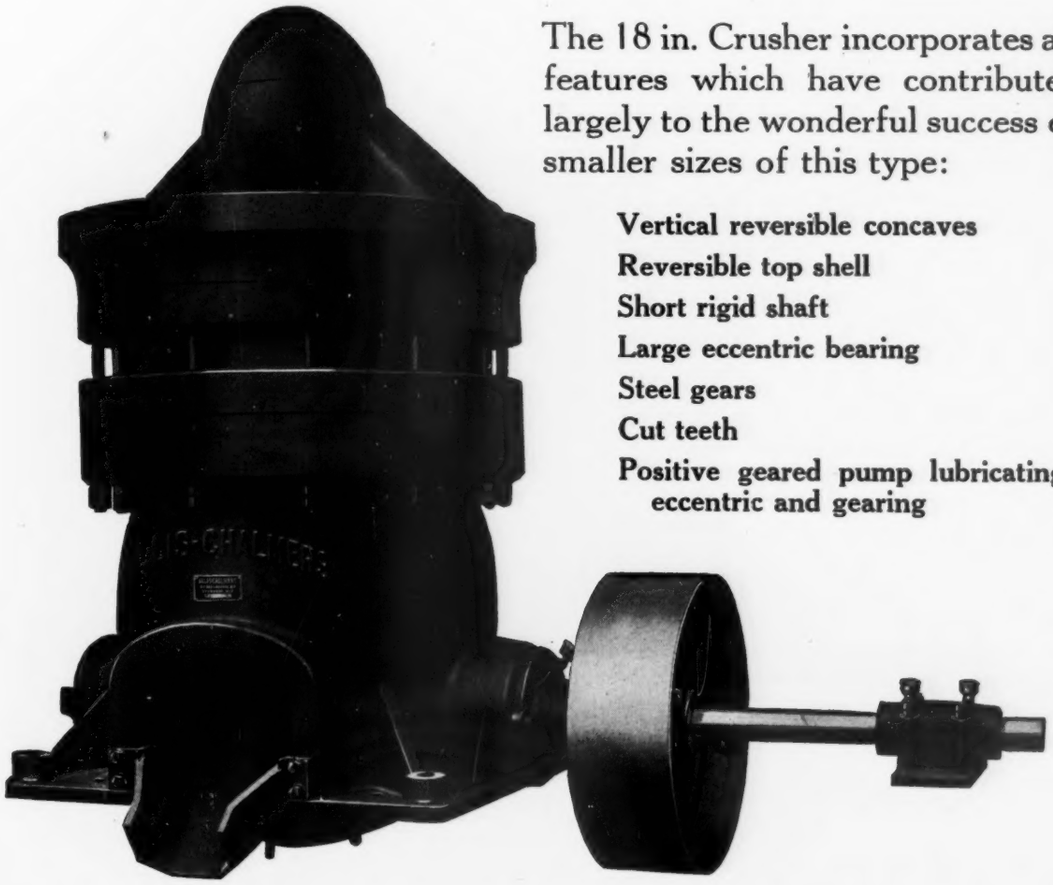
Walshe, Joseph A.: Deep hole drilling with hammer type drills.....May 30 46
Warner, Charles:
—— Again elected president of National Lime Association.....June 13 33
—— Manor plant near Tullytown, Penn.....May 30 27
Warner, Irving, patent for increasing efficiency of rotary lime kilns.....July 11 36
Warrior Cement Corp.:
—— Improves Demopolis plant.....Sept. 5 108
—— Takes over Gulf States plant.....Aug. 22 70
Watertown Stone Products Co. plant..Aug. 22 49
Weigel, W. M.:
—— Requirements of sand for sand blasting.....Feb. 7 31
—— Requirements of special sands....Sept. 19 36
Welch, Frank M.: J. N. Dugan sand and gravel plant, Cincinnati, Ohio.....Oct. 3 44
West Virginia and Pittsburgh Sand Co. plant.....May 2 47
Western Road Show at San Francisco. Charles Geiger.....Dec. 12 46
What form of lime is best suited for agriculture? Alva Agee.....Feb. 7 42
Whiterock Quarries Co. hydrating unit..Aug. 8 71
Williams, A. W.: Dredging for sand and gravel in the Ohio river.....Nov. 28 58
Winter construction on the increase....Nov. 14 83
Wire, rope, Specification for.....July 11 58
Wisconsin Aggregate Producers annual meeting.....Dec. 26 159
Wisconsin Concrete Products Association program.....Mar. 21 75
Wisconsin state fair exhibits of concrete products.....Oct. 3 77
Wisconsin Lime and Cement Co.'s plant near Crystal Lake, Ill. Gordon Smith.....July 11 51

Y

Yardley, J. L. Mck.: Outline of gypsum production, An.....Jan. 10 44
Yosemite Portland Cement Co. reorganized.....Mar. 7 68

New 18 Inch Superior McCully Fine Reduction Gyratory Crusher

The latest development in the Superior McCully Fine Reduction line, furnished to a large Cement Company—having two feed openings, each 18 in. by 68 in., capable of taking the product from the largest size primary crushers. Capacity with minimum discharge opening of 2-1/2 in.—225 to 275 tons per hour.



The 18 in. Crusher incorporates all the features which have contributed so largely to the wonderful success of the smaller sizes of this type:

Vertical reversible concaves
Reversible top shell
Short rigid shaft
Large eccentric bearing
Steel gears
Cut teeth
Positive geared pump lubricating eccentric and gearing

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

National Crushed Stone Convention

Tentative Program for the Montreal Meeting

Monday, Jan. 18—Morning Session

Otho M. Graves Presiding

10 A. M.—Address of welcome by his worship Charles Duquette, mayor of Montreal.

10:15 A. M.—Response for the association and presidential address, Otho M. Graves.

11 A. M.—Appointment of convention committees, including committees on rules and procedure, resolutions, nominating, auditing, entertainment, reception, publicity.

11:15 A. M.—Reports of directors on business conditions in 1925 and the outlook for 1926.

12:45 to 2 P. M.—Group luncheons for the following groups: Highway, salesmen, superintendents, agricultural limestone, concrete aggregate and ballast and manufacturers' division.

Monday Afternoon Session

2 P. M.—"Proposed Research Work of the Association," A. T. Goldbeck, Director Bureau of Engineering.

2:30 P. M.—General discussion on Bureau of Engineering, led by ex-Presidents A. J. Blair, John Rice, E. J. Krause, W. Scott Eames, F. W. Schmidt and John J. Sloan.

3 P. M.—Address on "Testing Road Materials." (Speaker not yet selected.)

3:30 P. M.—Discussion and general business.

Monday Evening

7:30 P. M.—Opening of exposition, Highland Laddie Bagpipe Band.

9:30 P. M.—Smoker and entertainment, banquet room.

Tuesday, Jan. 19—Morning Session

10 A. M.—Address by Hon. J. L. Perron, K. C., Minister of Roads, Province of Quebec.

10:30 A. M.—Address by Prevost Hubbard, chemical engineer, Asphalt Association.

11 A. M.—Address by O. F. Johnson, assistant freight traffic manager, Lehigh Valley Railroad.

11:30 A. M.—"The Quarry Section of the National Safety Council and What It Plans to Do," E. E. Evans, president, Ohio Crushed Stone Association.

12 M.—"The Fire Hazard of Quarry Plants and How to Carry It," D. C. Souder, insurance manager, France Stone Co. Discussion, led by those who have lost plants by fire—John Rice, E. J. Krause, H. E. Bair and J. C. King.

12:30 P. M.—General business.

12:45 to 2 P. M.—Group luncheons.

Tuesday Afternoon Session

Session for superintendents and operating men, chairman, A. G. Seitz, Rock-Cut Stone Co.

2 P. M.—"The Human Element in Plant Operation," G. J. Whelan, president, Kelley Island Lime and Transport Co. Discussion.

2:30 P. M.—"The Advantages of a Tidy Plant," A. L. Scott, Le Roy plant, the General Crushed Stone Co.

2:45 P. M.—"Oxygen, the Wonder Worker," followed by a series of experiments with liquid oxygen and motion pictures by the director of the Welding Institute, Air Reduction Co.

3:30 P. M.—"When and How to Wash Stone," C. E. Krause, superintendent, Columbia Quarry Co. Discussion.

4 P. M.—"Rock Excavation on the Hydro Canal," F. A. Gaby, chief engineer, Hydro Electric Commission.

4:30 P. M.—"Difficult Problems," everybody.

3 P. M.—Sleighing trips to Mount Royal and toboggan slide.

Tuesday Evening

Professional ice hockey game, Ottawa vs. Canadians.

Wednesday, Jan. 20—Morning Session

10 A. M.—"Railway Ballast," A. C. MacKenzie, engineer maintenance of way, Canadian Pacific Railway.

Discussion led by—J. V. Neubert, engineer maintenance of way, New York Central Railroad; Maj. George P. MacLaren, engineer maintenance of way, Canadian National Railways; G. L. Moore, engineer maintenance of way, Lehigh Valley Railroad.

10:30 A. M.—Reports of standing committees: Ballast, John Rice, chairman; cost accounting, James M. Savage, chairman; membership, R. B. Tyler, chairman; standards, Col. O. P. Chamberlain, chairman.

11 A. M.—Address by Col. Frederic S. Greene, superintendent of public works, New York state.

11:30 A. M.—Address by S. L. Squire, deputy minister, Department of Public Highways, Toronto.

12 M.—Reports of convention committees: Rules and procedure, resolutions and auditing.

12:30 P. M.—General business.

12:45 to 2 P. M.—Group luncheons.

Wednesday Afternoon Session

Session of salesmen, Harry H. Brandon, Ohio Marble Co., chairman. (Program to be announced later.)

3 P. M.—Sleighing trips through old Montreal and French section.

Wednesday Evening

Annual Banquet

Toastmaster—E. M. Doolittle, Canada Crushed Stone Corporation, Limited.

Speakers—Sir Henry Thornton, director, Canadian National Railways; John A. Macdonald, state highway commissioner, state of Connecticut, president North Atlantic State Highway Officials Association; Charles M. Upham, state highway engineer, North Carolina State Highway Commission and director National Highway Research Board. (Two other speakers yet to be selected.)

Thursday, Jan. 21—Morning Session

10 A. M.—"Competition Between Various Aggregates," F. R. Kanengeiser, first vice-president and general manager, Bessemer Limestone and Cement Co.

10:30 A. M.—Address by Frederic E. Everett, commissioner and state engineer, New Hampshire.

Discussion on "Competition of Roadside Gravel Pits," led by C. M. Doolittle.

11 A. M.—"How Can We Increase Membership?" Discussion, led by Col. R. B. Tyler, membership committee.

11:30 A. M.—Address by William F. Williams, commissioner, Massachusetts.

11:45 A. M.—"How Can We Make Our Conventions of Greater Value?" Discussion, led by A. R. Wilson, Granite Rock Co.

12 M.—Report of railroad committee, W. L. Sporberg, chairman.

Discussion of report and of proceedings Ex Parte 87, led by Col. O. P. Chamberlain, J. J. Sullivan and E. J. Krause.

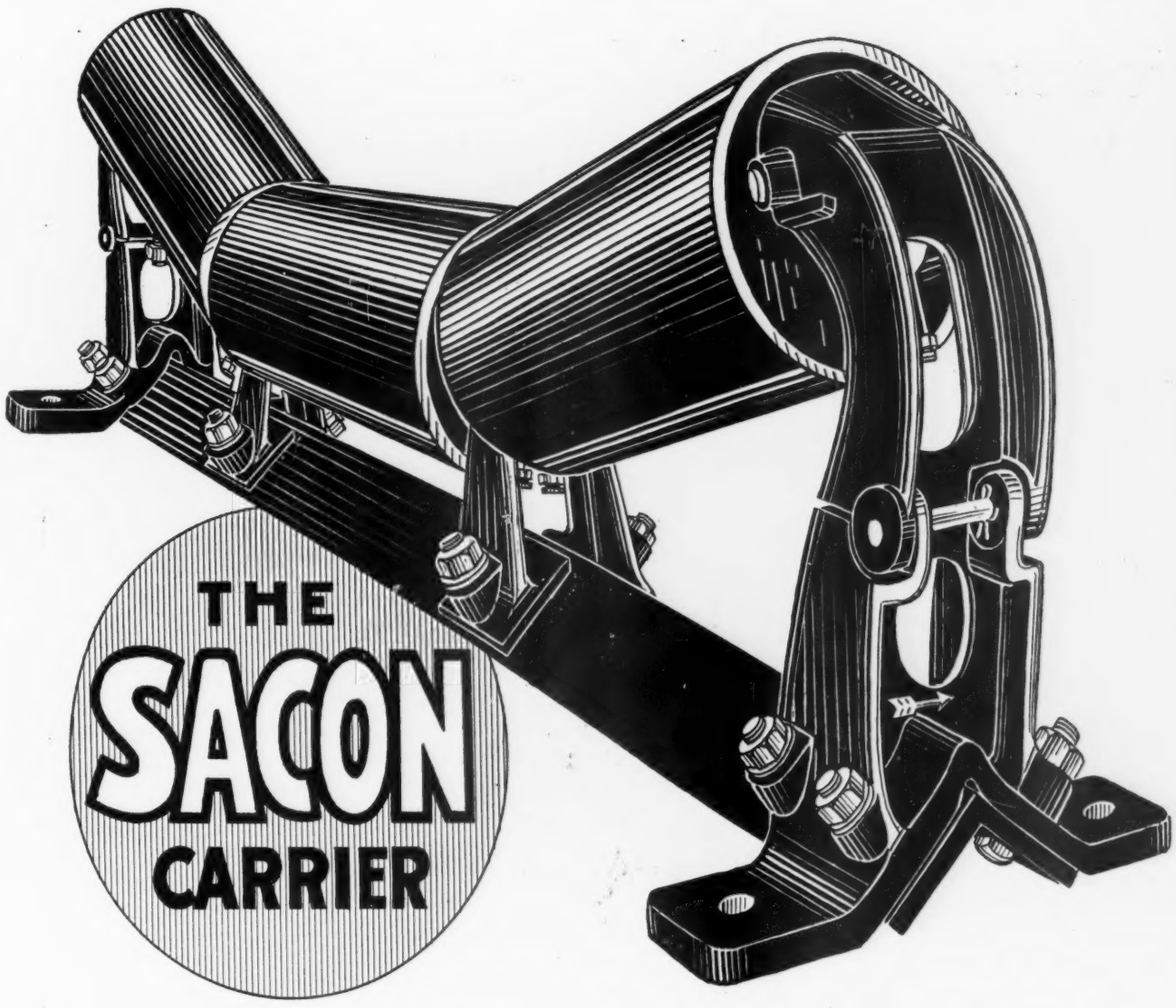
12:30 P. M.—Report of resolutions committee; report of committee on nominations; installation of officers for 1926.

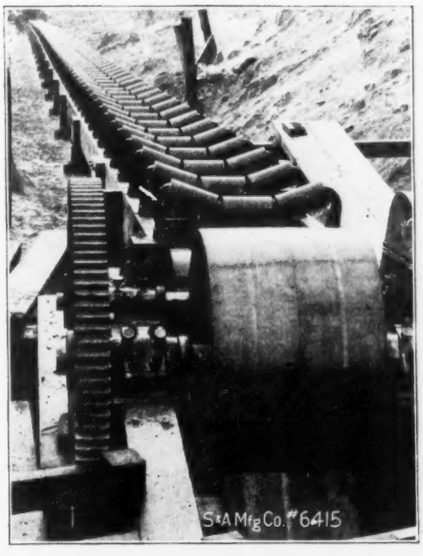
1 P. M.—General get-together luncheon.

Thursday Afternoon Session

2 P. M.—Agricultural limestone meeting, J. C. King, Agricultural Limestone Association, presiding.

2 P. M.—Meeting board of directors and officers, N. C. S. A.





Ingeniously devised. Carefully manufactured. Accurately assembled and tested.

All to produce the conveyor carrier which will operate with unusual smoothness and effect startling power economies.

This Sacon Carrier has struck a note of instant popularity with conveyor operators.

Send for Bulletin 143-R

STEPHENS-ADAMSON MFG. COMPANY
AURORA, ILLINOIS
PACIFIC FACTORY—LOS ANGELES

STEPHENS-ADAMSON
S-A BELT CONVEYORS

When writing advertisers, please mention ROCK PRODUCTS

Program of the National Sand and Gravel Association Convention

Excellent Papers and Discussions To Be Heard at the Atlanta Meeting

THE following is the official program of the National Sand and Gravel Association's annual convention to be held at Atlanta, January 19, 20, 21, 1926:

Sessions.—Sessions of the convention proper will commence promptly at 10:00 a.m., Wednesday and Thursday mornings. The afternoon sessions of the convention—Wednesday and Thursday—will commence promptly at 2:30. The annual dinner will be on Wednesday evening at 7:00 o'clock. A meeting of the board of directors will convene at luncheon on Tuesday, January 19. All meetings will be held at the Atlanta-Biltmore hotel.

About the Convention.—The meeting in Atlanta on January 19, 20, 21 will be in honor of the tenth birthday of the national association.

Under the present plan of organization of the association, the board of directors, at their annual meeting preceding the convention, dispose of the convention routine business, thus conserving the time of the convention proper and avoiding prolonged sessions. The board of directors will meet Tuesday noon, January 19, at 12:30 o'clock.

Reduced Passenger Rates.—The carriers have granted reduced rates of one and one-half fare for the round trip upon the certificate plan.

To the Ladies Wednesday and Thursday, January 20 and 21

Arrangements have been made with Mrs. Norman Sharp, president of the Atlanta Woman's club, to provide special entertainment features for the lady visitors of the convention as follows:

Wednesday morning at 10 o'clock, sightseeing trip to Stone mountain.

Thursday afternoon at 12:30 o'clock, luncheon at the Woman's club, with the National Sand and Gravel Association as host.

Tuesday at Noon, January 19

Annual meeting of the board of directors, to convene at a luncheon when members of the board will be guests of the national association. Luncheon will be served at 12:30 o'clock at the Atlanta-Biltmore hotel.

Among duties delegated to the board of directors by the constitution of the association, to be considered at the annual meeting of the board, are the following:

1. Preparation of plan of activities for the association during the ensuing year, and also a budget to cover such activities, for submission to the convention as a whole.
2. Nomination of candidates for the offices of president, vice-president, and secretary-treasurer, and also for three directors-at-large.
3. Selection from their own number of four members of the executive committee for the year 1926.

Stanton Walker, new director of engineering and research, N. S. G. A.

Wednesday Morning, January 20

10:00—Address of welcome, Hon. Clifford Walker, governor of Georgia.

10:30—Annual address of the president.

10:45—Annual report fo the secretary-treasurer.

11:00—"The Outlook for the Next Six Months," George E. MacIlwain, Boston. A practical analysis of business probailities with a reference to the country's construction program, with something about sand and gravel, pictured clearly and entertainingly. Standing as an independent economist, Mr. MacIlwain presents a carefully prepared composite of the best professional opinion—as represented by the leading statistical and economic services—translated into a workable program for the business man. Mr. MacIlwain will be glad to answer questions and his audience is urged to interrogate him.

11:30—"Special Sands as By-Products from the Average Commercial Plant," W. M. Weigel, United States Bureau of Mines, Department of Commerce.

Wednesday Afternoon, January 20

Convening at 2:30 p. m., there will be a meeting of the Concrete Products Division of the National Sand and Gravel Association, to which all are invited.

E. W. Dienhart, general manager of the Acme Concrete Products and Gravel Co., Cement City, Mich., a well-known authority on concrete products, will preside as chairman of the meeting of the Concrete Products Division.

Wednesday Evening, January 20

Annual dinner at the Atlanta-Biltmore hotel. Informal, music and dancing, entertainment.

Thursday Morning, January 21

10:00—"Selling Sand, Gravel, Rock, by the Ton, vs. Guessing by the Yard," E. Earl Glass, general manager, Pacific Coast Sand and Gravel Association, Los Angeles.

10:30—Report of the Washed Gravel Ballast Committee, Earl Zimmerman, Ohio Gravel Ballast Co., Cincinnati, Ohio.

11:00—"Should the National Association Promote Standardized Specifications for Sizes of Sand and Gravel? Stanton Walker, director, Engineering and Research Division, National Sand and Gravel Association.

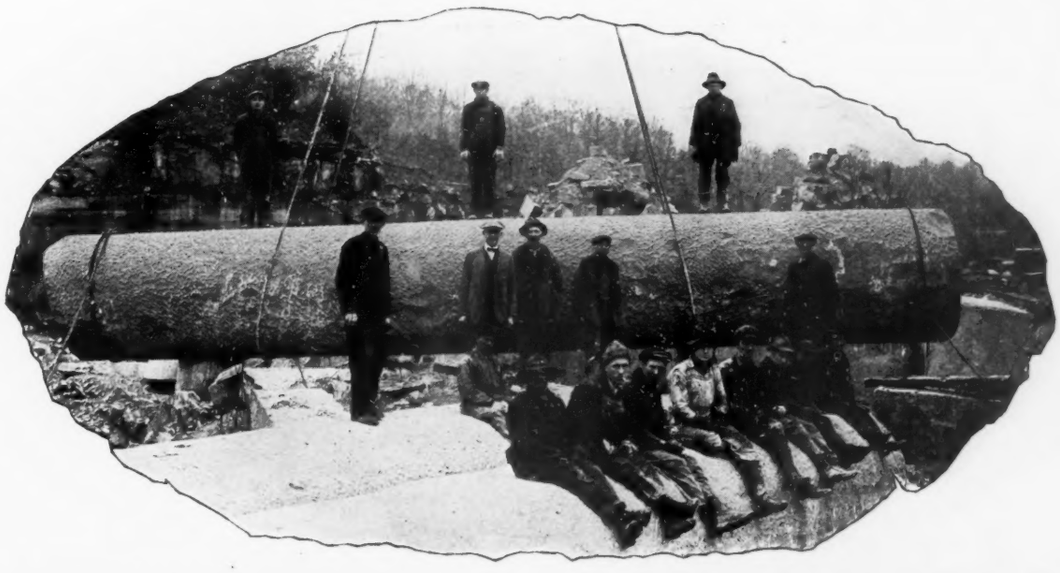
11:30—"The Continuation of Federal-Aid," W. C. Markham, American Association of State Highway Officials.

12:00—Consideration report of board of directors, reports of committees.

12:30—Election of officers.

Thursday Afternoon, January 21 Open Forum

Remarks by the charter members, best method washing sand and gravel, best method storage and reclaiming materials, advantages selling sand, gravel, rock by ton, demurrage on frozen shipments, inspection of materials at plant, how can irresponsibility be eliminated, publication for the sand and gravel industry, best method crushing material, best method of patching cars, split loads of sand and gravel, how to improve the quality.



"HERCULES" Red Strand WIRE ROPE

Strength for Safety — Endurance for Economy

A wire rope that is used for handling rock products must have strength, but strength alone will not enable it to do its work economically, for it must also have endurance.

All qualities necessary for hard work, HERCULES (Red-Strand) Wire Rope has. We see that it has by rigidly testing every wire that goes into it, and if any wire fails to meet our specifications, it is promptly rejected.

But the best recommendation for HERCULES Wire Rope is its actual performance. It is continually proving that it is the best wire rope for use on cranes, cableways, derricks, dredges, excavators, hoists, steam shovels and all other material handling equipment that requires extra strength and endurance.

The Wire Rope with the Service Record

Made Only By **A. Leschen & Sons Rope Co.** *Established 1857*

5909 Kennerly Ave., St. Louis

New York **Chicago** **Denver** **San Francisco**

SERVICE and QUALITY

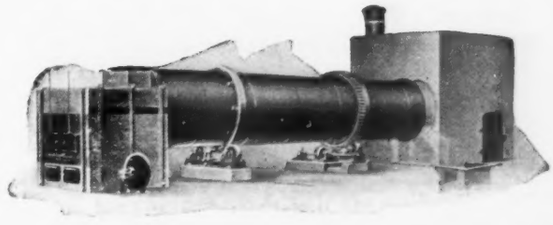
Jaite Puncture & Waterproof Paper Bags are Still Unbeaten

THE JAITE CO., Jaite, Ohio

Manufacturers

Paper and Paper Bags

WHEN BETTER BAGS ARE MADE JAITE WILL MAKE THEM

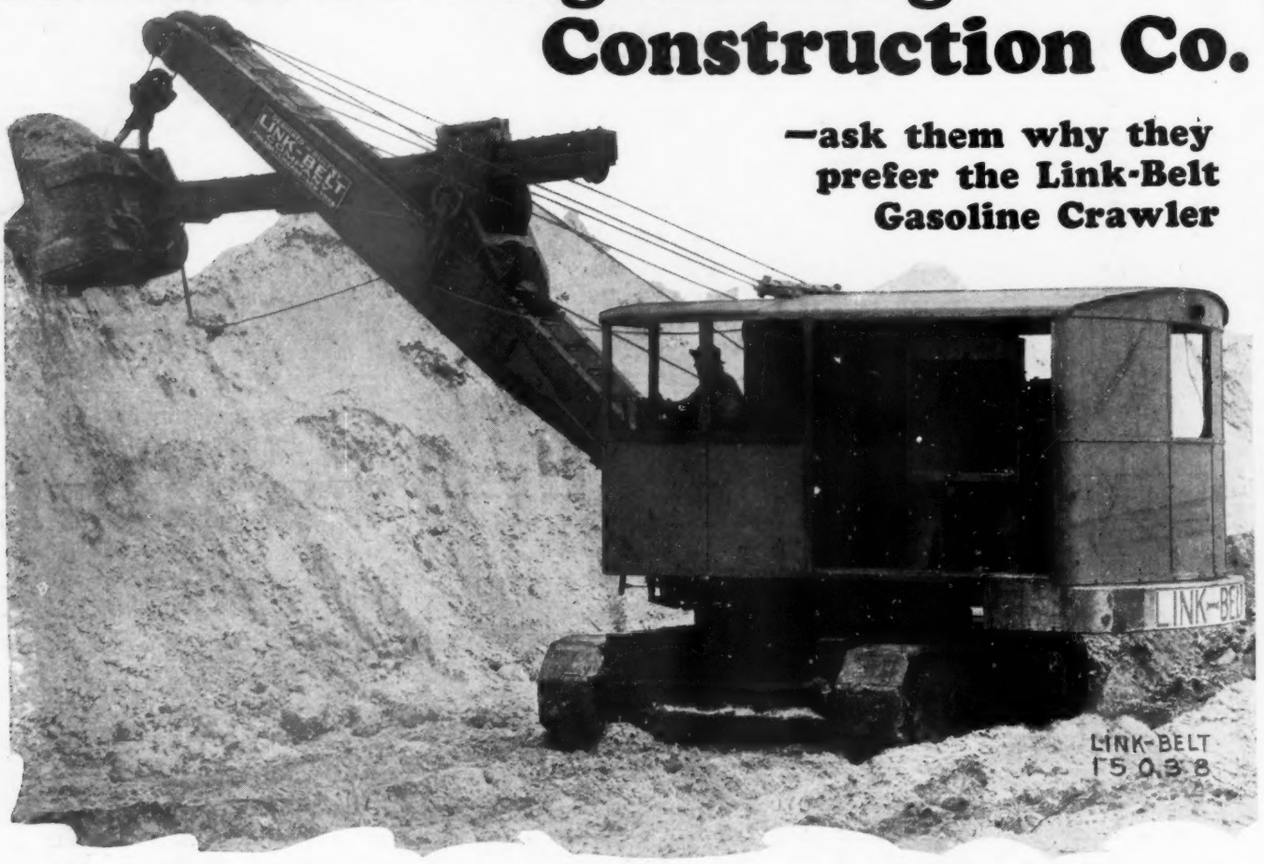


DRYERS

AMERICAN PROCESS CO. 68 Williams Street NEW YORK CITY

Four in a Row! Bought by the American Engineering & Construction Co.

—ask them why they prefer the Link-Belt Gasoline Crawler



TWO of the Link-Belt Crawlers owned by the American Engineering & Construction Co., of Miami, Fla., are working three 8-hour shifts a day on construction work for the Florida East Coast R. R. Co. at Hialeah, Fla. —doing three days' work in one, handling 6,000 cu. yds. per 24-hour day with the two machines.

Such performance, day after day, would not be possible without the many inherent advantages of the Link-Belt design, among them the easy operating clutches and brakes of ample size, the easily controlled powerful shovel crowd, the unusual strength and stability of the entire machine, and the fully encased trouble-free cut gear crawler drive and steering mechanism.

Built from the ground up for fast, reliable and cheap output, the Link-Belt Gasoline Crawler is today the greatest crawler crane value money can buy. Literature and full particulars on request. Address

2483

LINK-BELT COMPANY

Leading manufacturers of Elevating, Conveying and Power Transmission Machinery

CHICAGO, 300 W. Pershing Road — Offices in Principal Cities

San Francisco, 19th and Harrison Sts. — Fresno, Calif., 215 Brix Bldg. — LINK-BELT MEESE & GOTTFRIED CO — Oakland, Calif., 526 Third St. — Sea'tle, 820 First Ave. S. — Los Angeles, 400 E. Third St. — Portland, Ore., 67 Front St.

LINK-BELT

"Built for Service" CRAWLER CRANE

When writing advertisers, please mention ROCK PRODUCTS